MAY, 1961

Plant Engineering®

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The magazine that helps plant engineers with their everyday problems

Volume 15, No. 5 Circulation of this issue 52,126

SPACE–
TIME–
MONEY–––

Save All Three with Square D QMB POWER PANELBOARDS

MOTOR STARTERS AND BREAKERS OR SWITCHES COMBINED IN ONE SPACE-SAVING PANELBOARD!

FACTORY-WIRED AND ASSEMBLED OR ENCLOSURES AND COMPONENTS AVAILABLE FROM YOUR SQUARE D DISTRIBUTOR!

BREAKER AND SWITCH UNITS ARE EXCLUSIVE PLUG-IN CONSTRUCTION. INSTALLED OR REARRANGED IN MINUTES!

If the above installation had been made the old way —with trough, and ganging separate switches and starters—it would have taken at least six feet of wall space instead of 30 inches, and four times the installation time.

After this panelboard is installed, Square D's exclusive *PLUG-IN* design permits circuit changes without costly down time. For extra safety, plug-in units are mounted directly above starters, permitting interlocking. No starter or disconnect door can be opened when switch is "ON."

QMB panelboards accommodate reversing or non-reversing starters, sizes 0 through 4; plug-in circuit breakers through 225 amperes; plug-in switches through 200 amperes (bolted through 600 amperes).

Twin Unit (above) available 15-100 amperes
Single Unit available 125-225 amperes

Exclusive Breaker Unit Advantages:
Plug-in construction • Each unit in individual steel enclosure with dead-front construction • Combine switch and breaker units in same panelboard, if desired

Write for the complete story—Square D Company, Mercer Road, Lexington, Kentucky

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wherever electricity is distributed and controlled

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ENGINEERED PRODUCTS
for Plant Maintenance

Garlock CHEVRON* Packings of Teflon† afford greatly improved sealing over previous style used on soot blowers at Alabama Power Company.

To lengthen seal life and increase efficiency of retractable soot blowers, Alabama Power applies Garlock CHEVRON Packings of Teflon.

On a reciprocating rod moving once every eight hours for a 6-minute cycle, the packing seals 350° F scalding steam at 150 p.s.i. Garlock CHEVRON Packings of Teflon offer greatly improved service results over other packings formerly used at the Gorgas Steam Plant in Birmingham.

For peak, trouble-free efficiency wherever fluid power is used, hundreds of industrial plants and utilities like Alabama Power specify Garlock. CHEVRON Packings of Teflon cause minimum friction. There are two reasons for this: one, Teflon has the lowest coefficient of friction of any solid material in use today. Second, the Teflon CHEVRON itself is designed as an automatic packing. When pressures are high, the packings tighten to prevent leakage. When pressures decline, however, the rings close off so that, although positive sealing is maintained, the rod, ram or piston can move in a free, unhampered motion. This increases packing life and minimizes wear on the cylinder wall. Garlock CHEVRON Packings of Teflon are suggested wherever extreme temperatures (−100° F to +500° F) and corrosive conditions are encountered. For less-reactive applications, CHEVRON Packings are available in various combinations of cotton duck and rubber, rubber and asbestos, as well as homogeneous rubber and other elastomers to meet a wide range of service requirements.

For hydraulic-pneumatic service Garlock offers the most complete line of high-quality CHEVRON Rings, "V" Ring, "O" Ring, and U-Cup Packings in sizes and materials to suit all applications. Discuss your particular needs with the Garlock representative in your locale. Call him at the nearest of

GARLOCK

the 26 Garlock sales offices and warehouses throughout the U. S. and Canada. Or, write for Catalogs AD-115 (CHEVRON), AD-148 ("O" RINGS), and AD-145 (Cup Packings). Garlock Inc., Palmyra, New York.

Canadian Div.: Garlock of Canada Ltd.

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Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

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'ROUND ABOUT with the editors

Edited by R. L. Marinello

Corrosion Short Course

THE SIXTH Annual Appalachian Underground Corrosion Short Course will be held at The West Virginia University, Morgantown, West Virginia, June 6, 7 and 8.

The program will consist of approximately 65 papers covering basic, intermediate and advanced education of corrosion control as related to underground pipe, cable and water systems. Ten new subjects related to these categories will be included.

Also included in the course agenda are field demonstrations of control corrosion equipment, a three-hour corrosion control open discussion period and exhibits of materials and equipment.

Further information may be obtained by contacting John H. Alm, 2 Gateway Center, Room 605, Pittsburgh 22, Pennsylvania.

E.M. Engineers Learn About Bus Duct

ABOUT 200 Electrical Maintenance Engineers in the southern chapter of the E. M. E. Division of the Electric Association learned about modern applications of bus duct systems at their March meeting. Presented by George A. Fassnacht, Sales Manager, Bus Duct Systems, BullDog Electric Products, Detroit, Mich, the talk covered new developments and time-saving features of modern bus duct systems.

George Fassnacht, BullDog Electric Products, left, shows Plant Engineering Editor, Tom Hanson, how bus plug is inserted in a bus duct system.

The E. M. E. organization in the Chicago area presently has about 400 members in two chapters. All electrical engineers, electrical foremen and supervisors are invited to attend these meetings and join the E. M. E. Regular programs of interest to anyone connected with electrical work in industry are scheduled throughout the year.

Our electrical editor, Vern Kempf, is active in this organization and publishes "E. M. E. News," a four-page monthly bulletin telling about coming meetings and activities. If you would like to know more about this group and their activities in the Chicago area, write to Vern Kempf, Electrical Editor, PLANT ENGINEERING, 308 East James Street, Barrington, Illinois.

Automatic Control Conference

FIVE PROFESSIONAL societies have put their heads together to find some means of eliminating redundant meetings and yet provide a comprehensive forum for automatic control theory and application. The result is the 1961 Joint Automatic Control Conference. It will be held in Boulder, Colorado, from June 28 to the 30.

The five societies—AIChE, AIEE, ASME, IRE and ISA—set up a program committee to review the 123 contributed papers and select those which they felt would be of the most interest. They have selected 59 which will cover material on the following subjects; hydraulic and pneumatic control, optimum switching, process dynamics, automatic control applications, nonlinear control systems, time series and process identification, and many others.

Advance programs and registration forms are available from the Meetings Manager, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa.

Geodesic Storage Building Erected for Construction Job

AT THE Krummrich plant of Monsanto Chemical Co., the first Geospace dome for industrial construction storage was erected recently. The dome, a 22-ft diameter building, is composed of triangles of a ½-in.-thick polystyrene foam-kraft paper sandwich. Lightweight and portable, it is designed by its manufacturers, the Filtered Rosin Products Co., a subsidiary of Monsanto Chemical Co., to be erected at any jobsite, by the construction forces in the field.

PLANT ENGINEERING construction

Subscriptions: U.S.A. $10. Canada $11. Other countries $12 per year. Single copies $1. Change of address: Send to PLANT ENGINEERING, Circulation Division, Barrington, Illinois. Please supply position title, company name, company address. Request must reach us by the 15th of month to make the change effective with following month's issue. Published monthly and accepted as controlled circulation publication at Milwaukee, Wis.

BPA NBP

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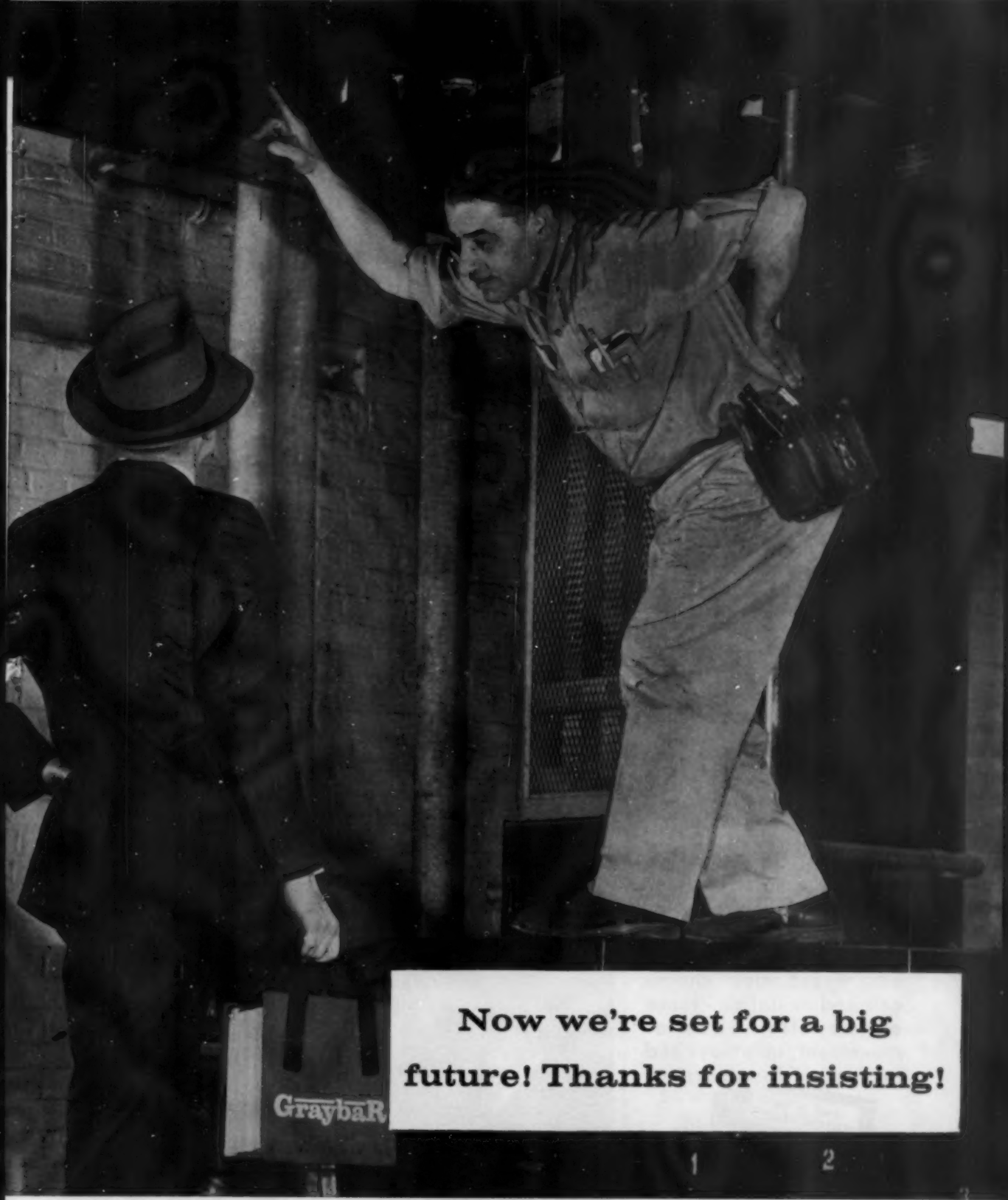

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Include the Graybar man in your electrical planning.

The recommendation he makes comes from experience with countless kinds of *power distribution equipment,* motors, controls, wiring and lighting supplies.

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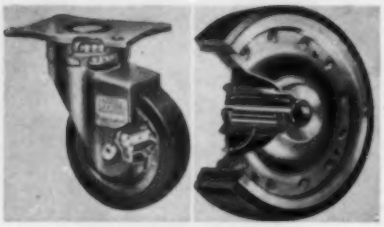

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to meet all needs of industry

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'ROUND ABOUT

W. E. Chandler, left, of Monsanto Chemical Co., points out features of geodesic dome to Plant Engineering's Andy Anderson. Door is a foam panel.

editor Andy Anderson was on the site during erection of the dome, which will be used for temporary storage of controls, valves, etc., during construction of an addition to the Krummrich plant.

Using the instruction manual which accompanies each dome, tradesmen working on the plant expansion erected the dome in less than a day's time.

The article on page 127 which features progress shots of the dome erection, provides more detail on this unique structure.

Western Plant Maintenance and Engineering Conference

PLANT ENGINEERS in the western states will again have a Plant Maintenance and Engineering Conference right in their own back yard. The last time this happened was in 1957. This year it will be at the Los Angeles Pan Pacific Auditorium, on July 18 and 19. The Western Plant Maintenance and Engineering Show, to run concurrent with the conference will be for three days, July 18 through the 20.

Some of the subjects which will be discussed at this conference are: Preventive Maintenance, Using Data-Processing Equipment; How to Get the Most Out of Your Electrical Power Dollar; Controlling Industrial Air Pollution; Work Sampling, How to Do It, How to Use It; Slashing Indirect Labor Costs; Budget Planning for Plant Engineering and Maintenance; and What Plant and Maintenance Engineers Want from Management.

For further information about the conference or to obtain advance show registration cards, contact Clapp & Poliak, 341 Madison Ave., New York, or their office in San Francisco at 681 Market St.

Author Has "Drive"—Turns Words Into Money

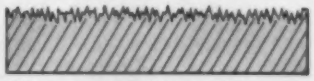
R. G. Marsh, center, is author of the article "Selecting Motor Drives," appearing on page 114 of this issue. He is in the Variable Speed Department of Allis-Chalmers Manufacturing Co. Here he accepts Plant Engineering's check in payment for this article from J. L. Wyler, Manager, Sales Promotion, Allis-Chalmers, left. At right is W. H. Davis, Manager, of Allis-Chalmers' Electrical Department. These men are located at Norwood, O.

CLIMAX MOLYBDENUM

Molysulfide® News Digest

CLIMAX MOLYBDENUM COMPANY, a division of American Metal Climax, Inc., 1270 Avenue of the Americas, New York 20, N.Y.

MOLYSULFIDE INCREASES TOOL LIFE AS MUCH AS 300 PER CENT



When magnified, a piece of highly polished metal is actually smooth to touch, yet presents a cross-section of saw-tooth irregularity. Molysulfide fills in the valleys, prevents the peaks from tearing, permits plastic deformation of the metal to make a smoother surface.

COMPOUND CONTAINING MOLYSULFIDE REDUCES MACHINERY WEAR-IN TIME

During the wear-in period of machinery, permanent surface damage . . . variously described as *galling, scuffing, scoring, tearing, scratching, excessive abrasion* and *seizing* . . . is an inherent hazard.

After years of experience, leading equipment builders agree that an MoS_2 compound is the best guarantee against wear-in damage. Here are five ways such a compound, applied to moving parts prior to operation, can save you wear-in time, money and possible grief:

1. Shortens wear-in period without use of abrasives.
2. Eliminates stick-slip behavior and resists galling and seizing at bearing pressures far beyond the yield point of any metals.
3. MoS_2 particles have a tenacious adherence to bearing surfaces. Will not scrape off.
4. Need not be burnished into surface. Brush or wipe on a thin coating.
5. Inexpensive in the long run. A little goes a long way.

When writing, refer to CL-103

MoS_2 Provides Greater Resistance to Wear at High Temperatures

The Alpha-Molykote Corporation in Stamford, Conn., is now marketing a new Molysulfide bonded lubricant for ferrous surfaces.

Applied with a conventional paint spray gun, this compound fills the microscopic valleys of the surfaces of tool steel and gives on-the-spot lubrication that allows the chips to glide. Once sprayed, it dries at room temperature to a tough film that has a thickness of 0.0001—0.0008 in. and a coefficient of friction of 0.03 at 100,000 psi.

Extremely resistant to wear at high pressures and temperatures (operating temperature range -300 to 600 F) this new compound requires neither chemical nor mechanical surface pretreatment and, because of its high adherence and low friction coefficient, it increases cutting tool life as much as 300%.

Effectiveness of this lubricant comes mainly from the weak layer-to-layer bonds which allow easy sliding and, within individual layers, from the cohesive forces between Mo and S atoms that are quite strong and prevent penetration by surface asperities.

Minimum coverage coating is 285 sq. ft./lb., and consumption is about 1% of tool weight. Normal lubricating oils, cutting fluids or solvents have no effect on these coatings.

When writing, refer to CL-101

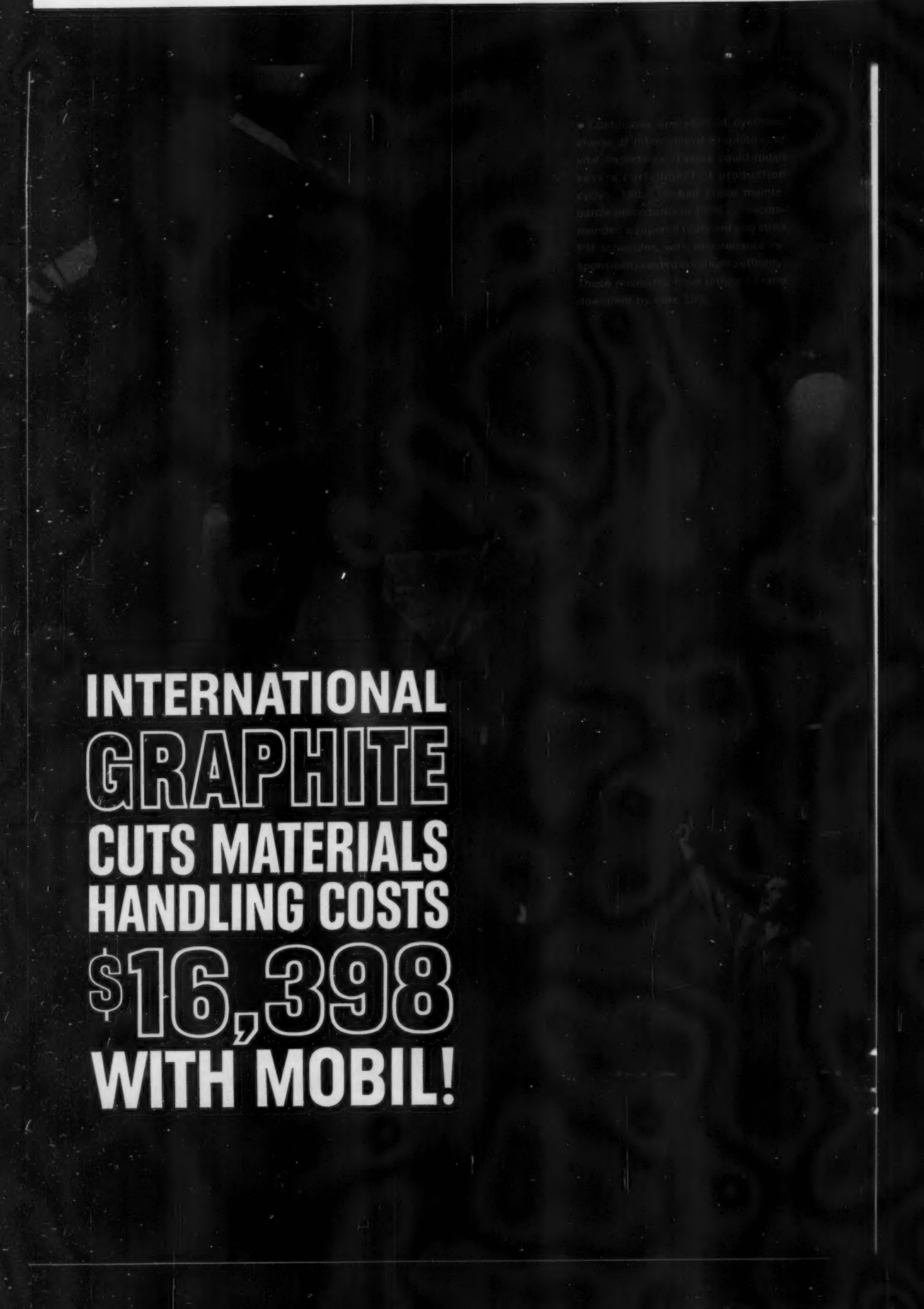
Punch Life Increased from 2,000 to 25,000 Holes in Steel Plate

These punches (11/16") were used to punch 25,000 holes in ½"—1020 cold rolled steel plate. Without a lubricant containing MoS_2, a maximum life of only 2,000 holes could be obtained.

A West Coast manufacturer was experiencing low punch life with the best available lubricants. His multiple punching operation consisted of cold shearing 50 holes simultaneously in a single steel plate. A maximum life of 2,000 holes per punch was obtained with ordinary lubricants.

Then, a compound containing Molysulfide was applied to the punch. The result: punch life was increased from 2,000 to 25,000 holes and, as can well be imagined, considerable savings were effected.

When writing, refer to CL-102


INTERNATIONAL
GRAPHITE
CUTS MATERIALS
HANDLING COSTS
$16,398
WITH MOBIL!

● In addition to direct savings through use of premium oils and greases, there have been immediate and long-term cost reductions through greater engine efficiency and driver training. Gasoline savings have been particularly impressive. Despite increased plant activity, International Graphite has achieved a 30 month total savings in lower gasoline costs of over $5,692.

● For vehicular materials handling units, Mobil made these recommendations: installation of hour meters; proper use of premium lubricants; servicing on a 50-operating-hour basis (about 2 weeks) rather than on a rigid once-a-week schedule. Air cleaners better suited to the conditions of operation were installed. As a result, scheduled servicings have been reduced by an average of 633 annually. In the past 30 months cost of oil, grease and labor have been reduced $8,206.

● International Graphite's Maintenance Superintendent, Mr. Mel Price, center, reports that there have been substantial savings, too, in the area of motor overhaul. Prior to changes recommended by Mobil in 1958, complete motor overhauls averaged 9 a year on 25 vehicles. During the last 30 months, this has been reduced to an average of 7 a year. Resultant savings in reduced labor and parts costs have amounted to $2,500.

● For over 20 years, Mobil has helped reduce costs for the International Graphite and Electrode Division of Speer Carbon Company, Niagara Falls, New York, a major producer of such finished graphite products as anodes, electrodes, and molds, as well as specialties for the railroad, chemical and munitions industries.

International Graphite faces exceptionally severe maintenance problems because of highly unusual conditions at the plant. Abrasive particles of carbon, sharp sand and silicon-carbide find their way into all types of materials handling equipment, necessitating a heavy schedule of preventive maintenance. By recommending superior lubricants and improved PM techniques, Mobil Engineers have helped International Graphite effect an additional $16,398 reduction in costs of maintaining and operating this equipment during the past 30 months.

Consistently over the years, Mobil has *proved* its value to industry. To learn how Mobil may help you, call your nearest Mobil Representative. Or write, Mobil Oil Company, 150 East 42nd St., New York 17, N. Y.

Mobil

For more facts circle 506 on Reply Card

CHICAGO'S MERCHANDISE MART CUTS NOISE WITH WESTINGHOUSE TRANSFORMERS, GAINS UNEXPECTED BONUSES

The Merchandise Mart, famed showplace of Chicago, contains 93 acres of floor space, houses approximately 30,000 persons working for major national concerns that demand top service. The Mart recently installed 40 Westinghouse DS-3 dry-type transformers to reduce noise levels and improve tenant comfort and efficiency.

Transformer noise sounding through Chicago's vast Merchandise Mart doesn't plague tenants and visitors any more. Mr. James Clark, Electrical Foreman, tells why.

"When our local utility began supplying current at 480 volts, our transformers were just too noisy. They were located in the stair wells, and their noise was intensified by the echo-chamber effect of the surrounding concrete walls. Some of our tenants began to complain. We tested a Westinghouse DS-3 dry-type transformer which proved to be virtually noiseless and decided to install 40 units.

"We found a two-man crew could hang these lightweight transformers near the top of the wall on angle frames in a short time. This saved stairwell space and allowed us to locate the transformers nearer load centers. So we saved on secondary cable and improved voltage regulation.

"Our former transformers were top-connected with primary cable. Heat rise baked out the insulation and we were constantly replacing cable. Since the Westinghouse DS-3's are bottom-connected with maximum terminal compartment temperature of 50°C, this costly problem has been eliminated."

In addition, Mr. Clark reports that maximum safety — an important consideration in a densely populated building — is assured with Westinghouse DS-3 transformers. They are explosion-proof, eliminate the danger of fire and, in the event of failure, allow no possibility of toxic gas inundation.

Westinghouse DS-3 transformers can help you solve your transformer problems. Your nearest Westinghouse representative will show you how. Contact him . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

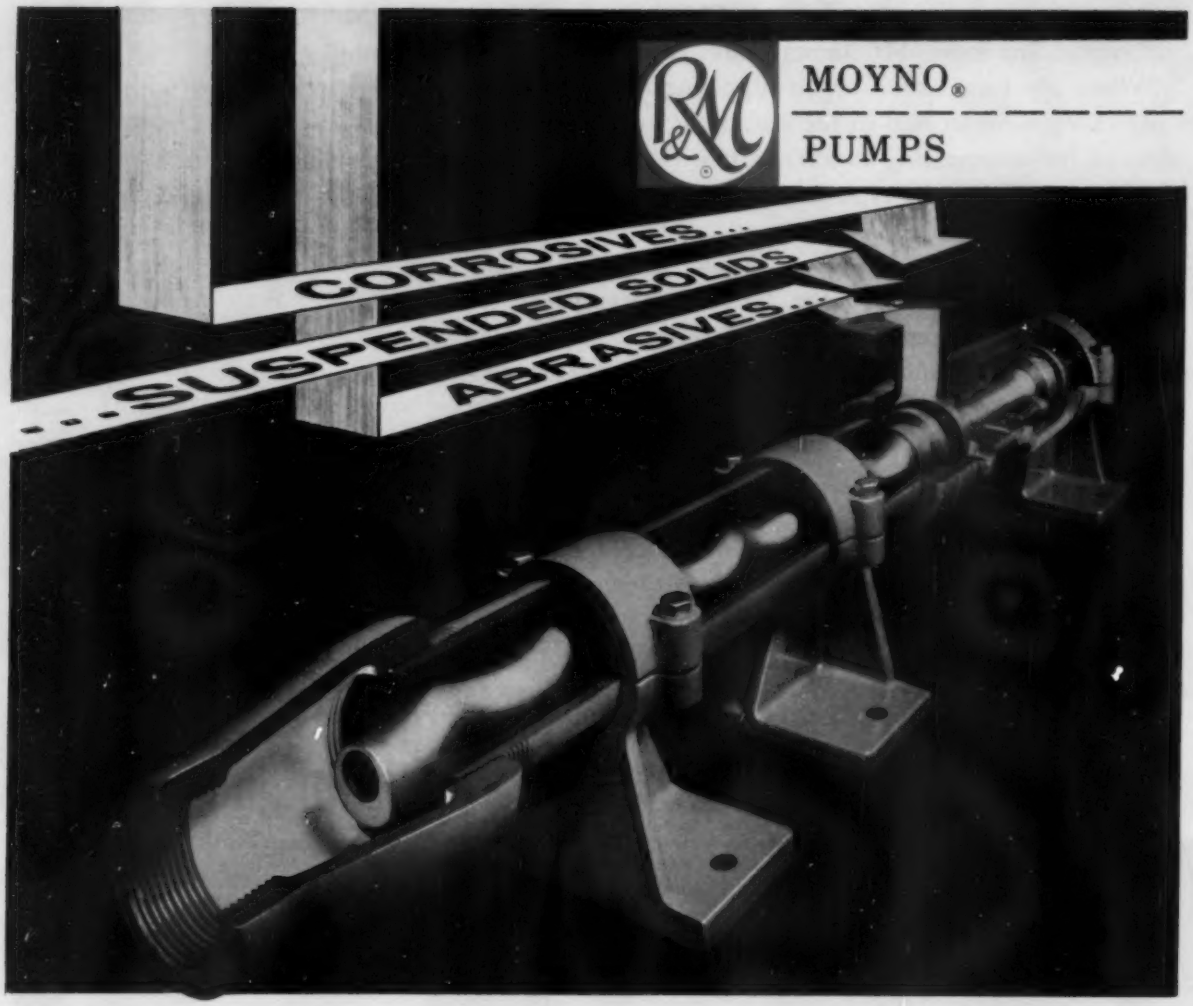
J-70961

You can be sure . . . if it's **Westinghouse**

Mr. James Clark, Electrical Foreman for the Merchandise Mart, found that Westinghouse transformers were not only practically noiseless but also accomplished big savings on installation costs, space and maintenance.

Space-saving, super-quiet Westinghouse transformers are used throughout the Merchandise Mart to step down 480 volt-ages from transmission lines to 120/240 volt distribution system serving lighting and other electrical equipment. Requiring no vaults, transformers are located mainly on stair landings.

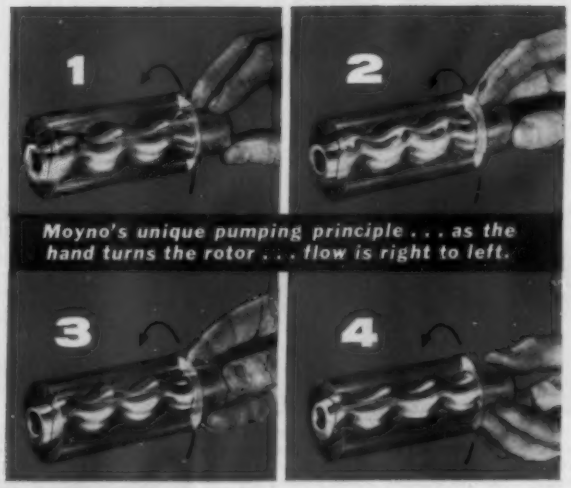
For more facts circle 507 on Reply Card



MOYNO® *solves tough pumping problems!*

Moyno's "progressing cavities" successfully handle thin watery slurries, non-pourable abrasives, gnawing corrosives or suspended solids up to 1⅛" dia.—without crushing, foaming or aerating! Material contacts only one moving part, a screw-like rotor revolving in a double-threaded stator. Where corrosives or abrasives are to be handled, rotor and stator are made of special resistant materials that minimize maintenance and prolong pump life. Many materials now pumped by Moyno were once considered "unpumpable" . . . had run up prohibitive maintenance costs on other type pumps or ruined them completely!

Moyno pumps are available in capacities to 500 gpm; pressures to 1000 psi. Learn more . . . write today for new Bulletin 100-PE!



Moyno's unique pumping principle . . . as the hand turns the rotor . . . flow is right to left.

ROBBINS & MYERS, INC., Springfield, Ohio

Fractional and Integral HP Electric Motors • Electric Hoists and Overhead Traveling Cranes • Moyno® Industrial Pumps
Propellair® Industrial Fans • R & M-Hunter Fans and Electric Heat • Trade-Wind Range Hoods and Ventilators
Subsidiary companies at: Memphis, Tenn., Pico Rivera, Calif., Brantford, Ontario.

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from machine tools to typewriters . . .

. . . Robbins & Myers motors power them all!

Each R&M motor, 1/200 through 200 HP, is electrically and mechanically designed with life-prolonging features which assure dependable operation, simplified installation and low maintenance. From rugged machine tools to complex business machines, there's an R&M motor for every job . . . Fractional and Integral H.P. Motors and Motor Parts in all popular mountings, electrical types and enclosures. Most are ready for off-the-shelf delivery. Others can be quickly produced. Should you require custom motors, R&M's experienced application engineers, aided by modern electronic computers, can furnish the one design best suited to your needs.

Write today for information, or send your powering problem to R&M. No obligation, of course!

integral motors, 1 thru 200 hp
fractional motors, 1/200 to 1 hp
special application, 1/100 thru 1/3 hp
universal or series parts, 1/50 to 1/2 hp

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Fractional and Integral HP Electric Motors • Electric Hoists and Overhead Traveling Cranes • Moyno® Industrial Pumps
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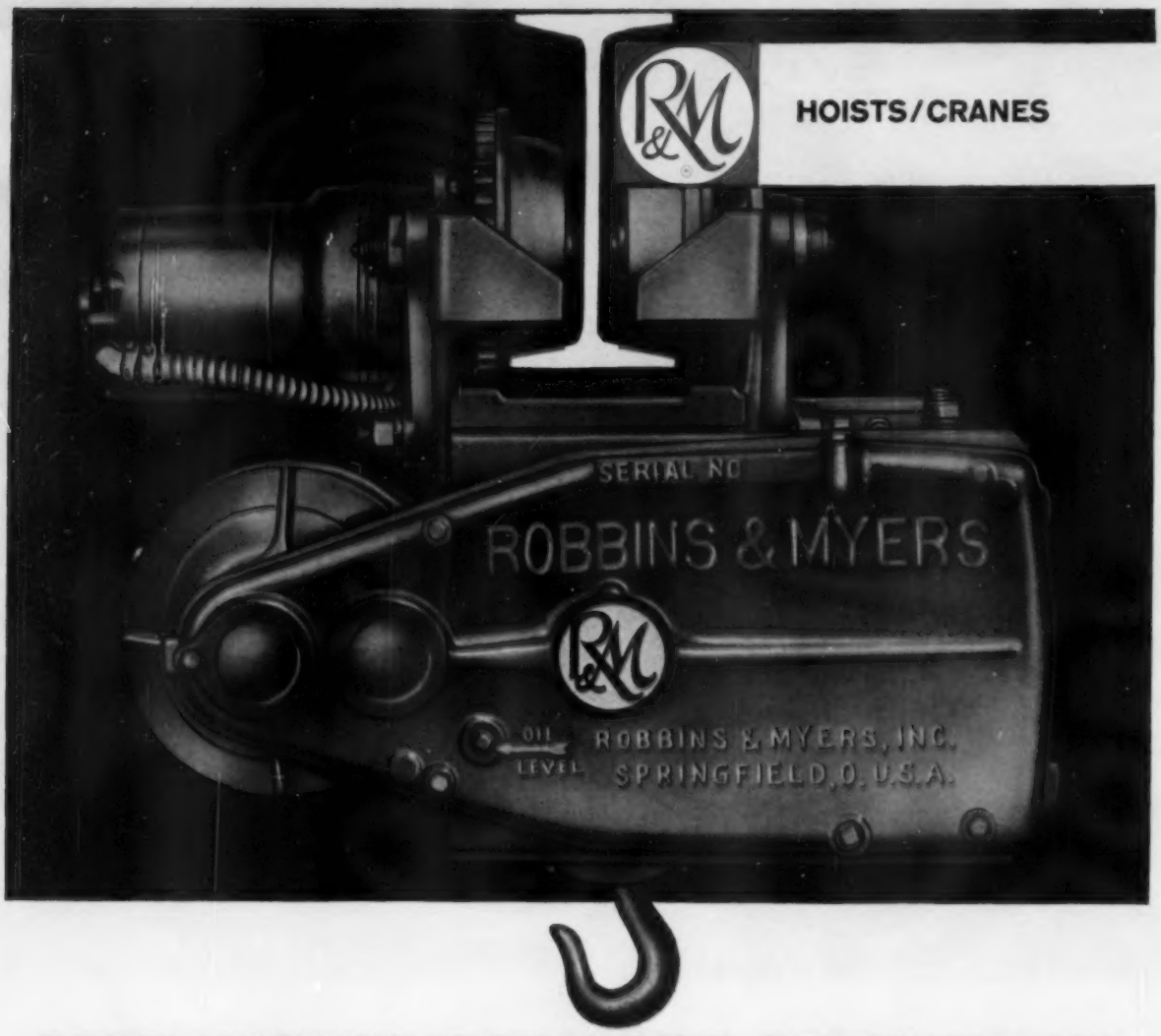
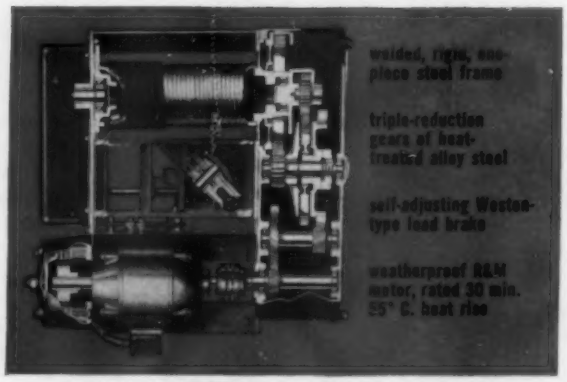


BEAM-HUGGING R&M HOIST SAVES SPACE

R&M Type F Hoists hug the beams to save valuable overhead plant space! The drum is along one side of the beam; the motor-and-brake assembly parallel along the other side. This compact design—*yours at no extra cost*—gives inches more usable lift, without building higher runways. It permits closer end approaches, provides greater side clearances. Many safety features protect operator, hoist and load—weight-type upper limit switch, low-voltage control circuit, fully magnetic control, Weston-type automatic load brake, and others. Type F Hoists are available in four frame sizes, ½ to 10 ton capacity, powered by 1½ to 15 HP R&M motors. Mountings include lug suspension, push-type, hand-geared, and choice of three motor-driven trolleys. Write today for Bulletin 920-PE


welded, rigid, one-piece steel frame
triple-reduction gears of heat-treated alloy steel
self-adjusting Weston-type load brake
weatherproof R&M motor, rated 30 min. 55° C. heat rise

take it up / *with R&M*®

ROBBINS & MYERS, INC., Springfield, Ohio

Electric Hoists and Overhead Traveling Cranes • Fractional and Integral HP Electric Motors • Moyno® Industrial Pumps
Propellair® Industrial Fans • R & M-Hunter Fans and Electric Heat • Trade-Wind Range Hoods and Ventilators
Subsidiary companies at: Memphis, Tenn., Pico Rivera, Calif., Brantford, Ontario.

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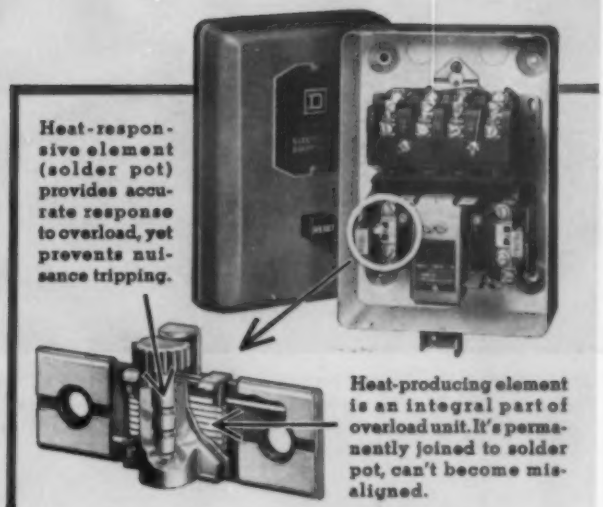
ONLY SQUARE D STARTERS WITH ONE-PIECE OVERLOAD RELAYS GIVE ABSOLUTE PROTECTION!

• Only Square D makes thermal overload relays with 1-piece construction—and only with 1-piece construction can you *know* you've installed the heater correctly. Square D 1-piece overload relays can be installed only one way. They are factory-assembled, individually tested and calibrated, completely tamper-proof. Repeated tripping will not affect accuracy.

You *pay* for overload protection—be sure you *get* it. Insist on Square D 1-piece overload relays for *absolute* protection.


Heat-responsive element (solder pot) provides accurate response to overload, yet prevents nuisance tripping.
Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

D EXCLUSIVE— 1-piece Overload Relay for *ABSOLUTE* Protection!

Mail coupon today for simple "jig-saw" demonstrator —see why only Square D gives absolute protection

Square D Company
Department SA-207
4041 North Richards Street
Milwaukee 12, Wisconsin

Please send me information on Square D magnetic starters, along with your simple 3-minute "jig-saw" demonstrator

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COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

SQUARE D COMPANY

wherever electricity is distributed and controlled

For more facts circle 511 on Reply Card

Anode casting wheel. Here, molten copper arrives at 2100°F., and is cooled to less than 1500°F. in equipment at right. Pydraul is used in all hydraulic applications close to open flames or extreme heat. It's noncorrosive and fire resistant. Gulf Harmony lubricates wheel rollers. And a Gulf E.P. Lubricant keeps the reduction gears in excellent condition.

Protects multi-million-dollar facilities with just six Gulf® lubricants...

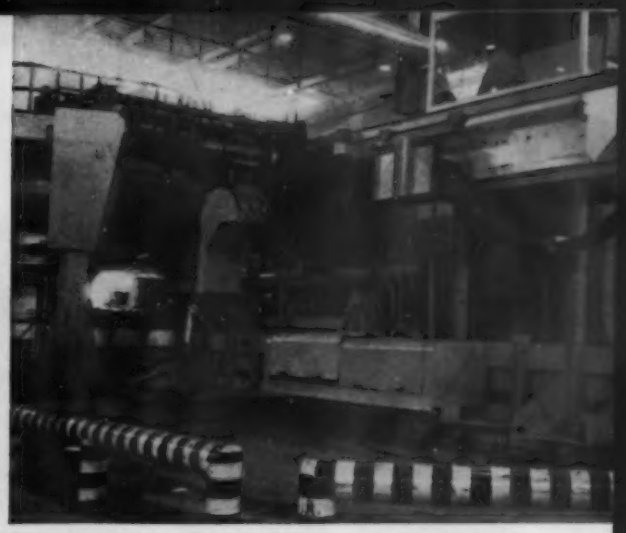
The Kennecott Refining Corporation, Ann Arundel County, Maryland, refines blister copper. It has invested over 30 million dollars in highly advanced production, quality control and materials handling equipment. Work force: 600 strong. So that's $50,000 worth of equipment per man.

This heavily automated refinery demanded a simple, yet effective lubrication program. To set it up, the Kennecott maintenance staff worked closely with Gulf engineers. The result: a program that requires only a small number of Gulf oils and greases.

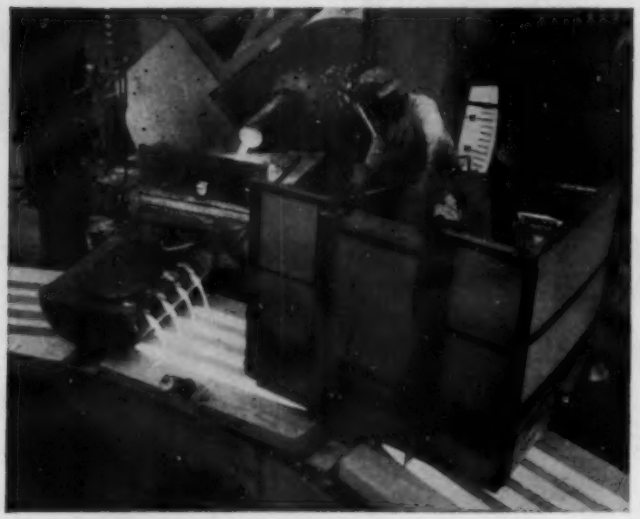
For instance, Gulf Harmony® oil is used in hydraulic systems that aren't exposed to extreme heat—assures smooth performance. And Gulf Harmony proves effective in other applications that require an oil with oxidation stability, water separation characteristics and sludge resistance.

Gulf E.P. Lubricants prevent excessive wear, keep maintenance costs low on equipment that undergoes shock loads and high pressures. Example: reduction gears on anode casting wheel and furnace chargers. A Gulf Sales Engineer reports that "The anode cast-

Stripper conveyer. Pulleys and gears are sprayed with Gulf Harmony 76. It's foamless. It's stable. And it provides effective protection against fumes from the electrolytic cells.



Charging machine. It feeds pre-heated cathodes to the 90-ton, 13,500 KVA electric melting furnace. Gulfcrown Grease E.P. is used in the central lube system of all furnace chargers and the rotary pre-heating furnace. It's oxidation-stabilized and protects against rust.



Wire bar casting wheel. The refined molten copper comes from a small induction furnace off the main arc furnace. Gulf Lubcote lubricates the rim gear, drive pinions and guide rolls. And Gulfcrown Grease lubricates the flexible couplings and mold tipping rollers.

Left to right. F. A. Gaidis, Plant Engineer, H. E. Nelson, Machinist Supervisor, and J. E. Foos, Gulf Sales Engineer. A small number of multi-purpose Gulf oils and greases gives the Kennecott Refining Corporation a simple, yet effective lubrication program.

against heat, sludge and wear
GULF MAKES THINGS RUN BETTER!

ing wheel's entire system was recently cleaned, and all reduction gears were in fine shape. No dirt or rust, or any indication of oil breakdown."

Gulfcrown® Grease E.P. is also specified for equipment that meets high pressures and shock loads. Gulf Lubcote® cushions gear-teeth sliding and rolling action on open gears. Reduces noise and wear. Finally, Kennecott uses Pydraul for hydraulic applications near open flames or high temperatures, and uses Gulfcrown Grease in a variety of conventional grease applications.

May we have the opportunity to work with you in setting up a similar money-saving lubrication program with multi-purpose Gulf lubricants? They'll help you cut maintenance costs and simplify lubricant application, storage and handling. Call a Gulf Sales Engineer at your nearest Gulf Office. Or write for free pamphlets.

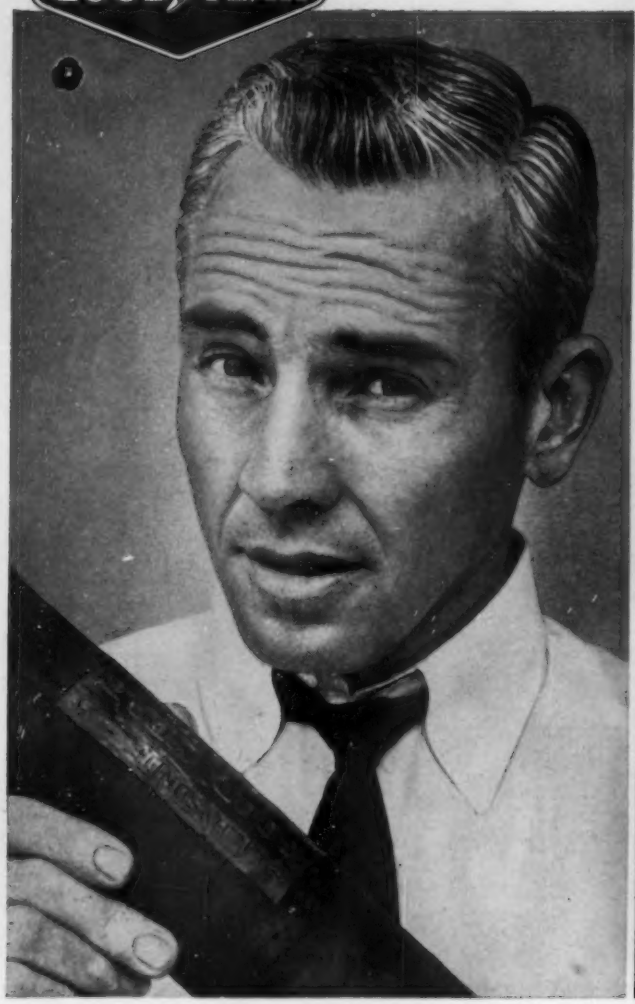
GULF OIL CORPORATION
Dept. DM, Gulf Building
Houston 2, Texas

GULF

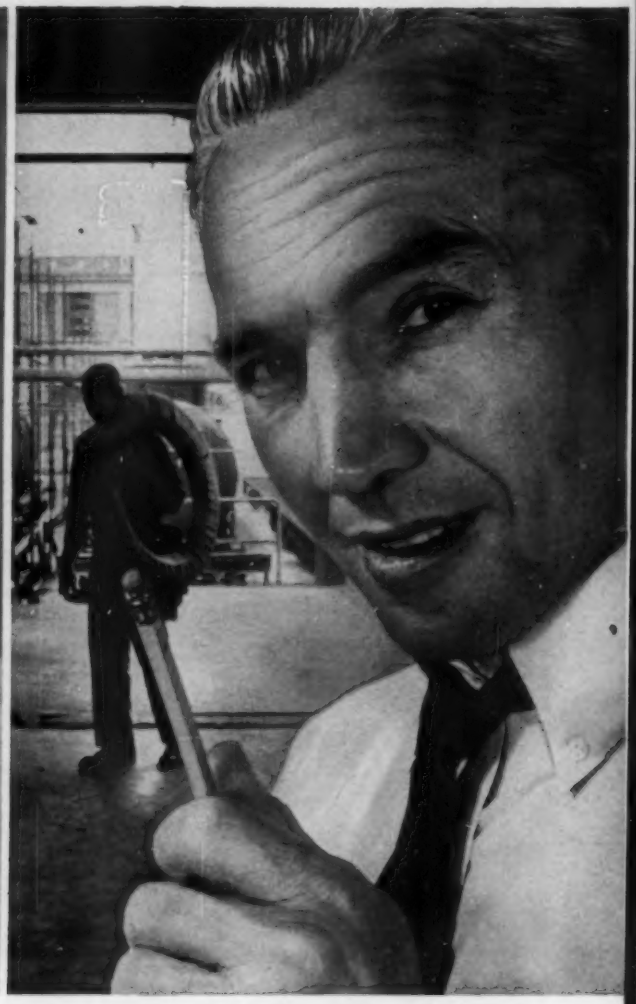
For more facts circle 512 on Reply Card

Why I always

GOODYEAR



THEY MAKE EVERY HOSE I NEED
(No more time and money wasted looking for exactly the right kind of hose for a job —*Goodyear's got it!)*

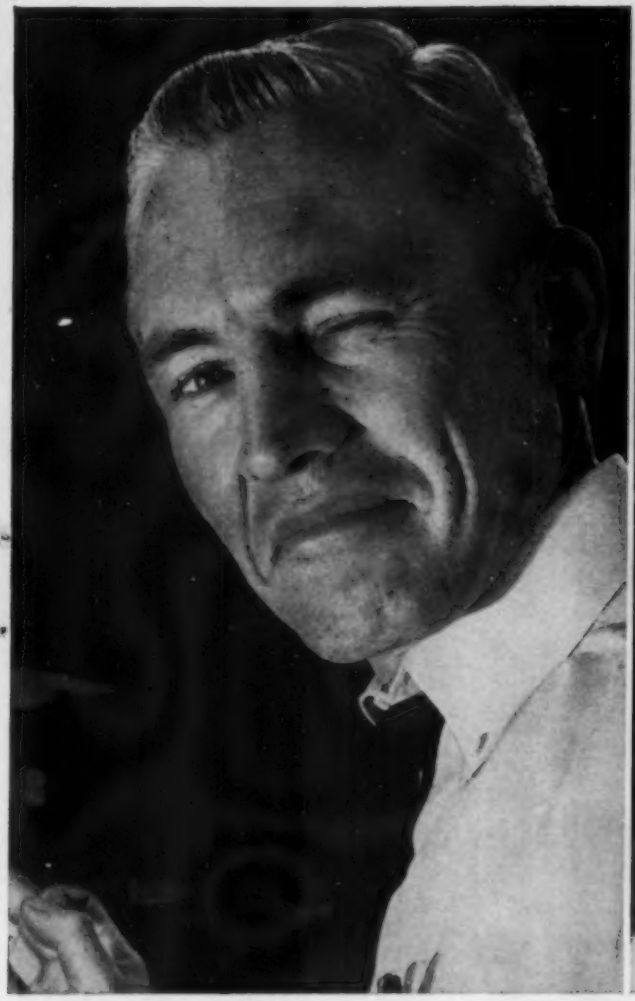


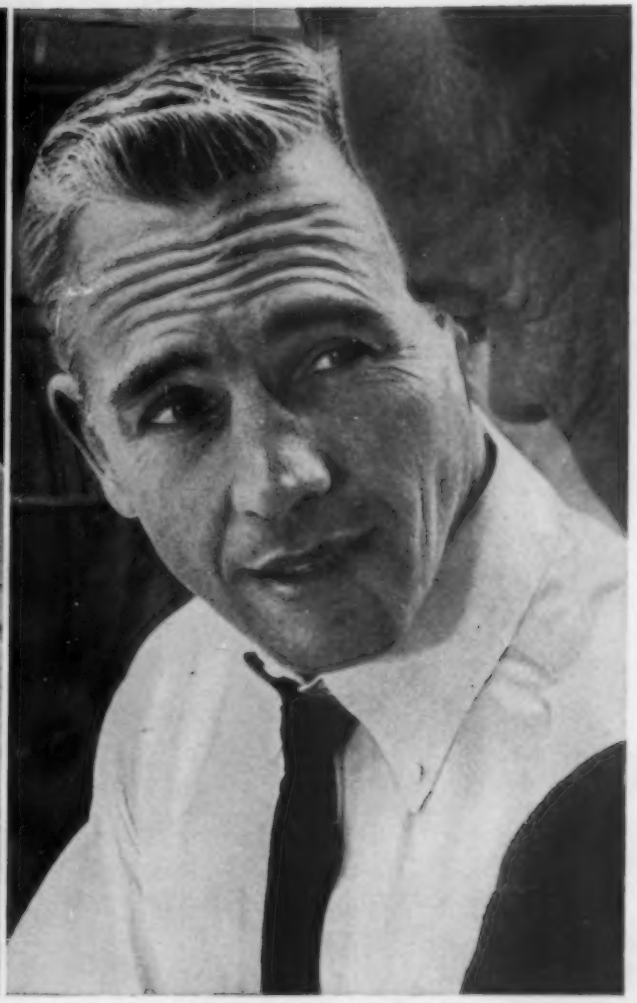
THEY'VE GOT FAST DELIVERIES I NEED
(No more out-of-stock delays! Via network of stocking distributors in all parts of the country—*Goodyear's got it!)*

For the right hose... at the right place... at your Goodyear Distributor... first in service

Lots of good things come from GOOD

buy hose from Goodyear





THEY HAVE TOP QUALITY I NEED
(No more settling for second-best. When it comes to quality, reliability and safety *–Goodyear's got it.)*

THEY OFFER TECHNICAL HELP I NEED
(No more guesswork. For expert help through the G.T.M. – Goodyear Technical Man–*Goodyear's got it.)*

the right time... at the right price... call with all industrial rubber products

Or write Goodyear, Industrial Products Division, Akron 16, Ohio

GOODYEAR INDUSTRIAL PRODUCTS

For more facts circle 513 on Reply Card

Owner: **Western Hotels, Inc.**
Electrical Engineer: **Mr. Fritz Klawa,** Portland, Ore.
Electrical Contractor: **Pitman Electric Co.,** Portland, Ore.

Electrical Protection is MODERNIZED with BUSS Fuses in the Multnomah Hotel, Portland, Ore.

In this well-known hotel of the Northwest, it became necessary to modernize the electrical system to take full advantage of the many uses for electricity today.

BUSS Hi-Cap and FUSETRON dual-element fuses were installed to assure safe, dependable and lasting protection.

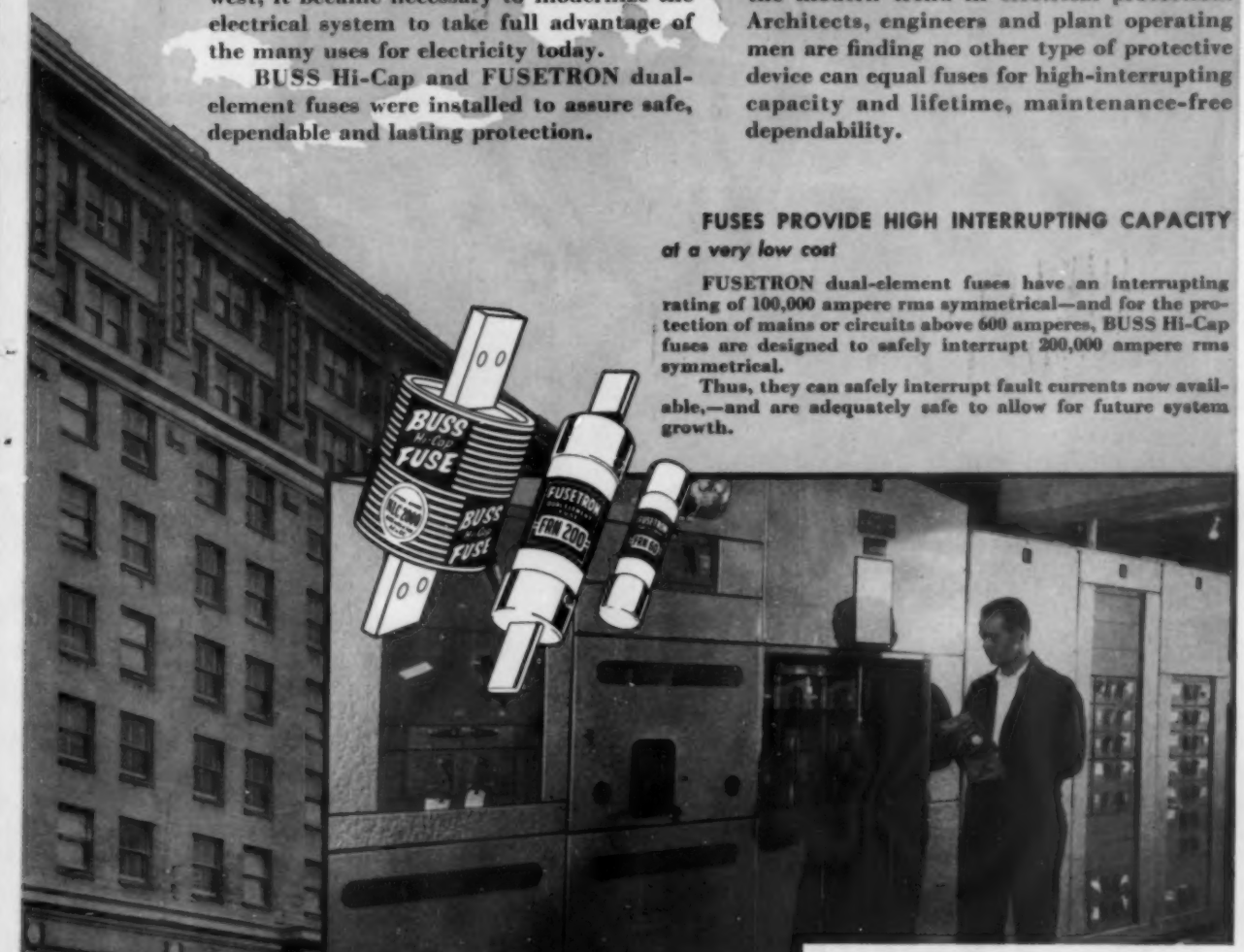
This installation is another example of the modern trend in electrical protection. Architects, engineers and plant operating men are finding no other type of protective device can equal fuses for high-interrupting capacity and lifetime, maintenance-free dependability.

FUSES PROVIDE HIGH INTERRUPTING CAPACITY

at a very low cost

FUSETRON dual-element fuses have an interrupting rating of 100,000 ampere rms symmetrical—and for the protection of mains or circuits above 600 amperes, BUSS Hi-Cap fuses are designed to safely interrupt 200,000 ampere rms symmetrical.

Thus, they can safely interrupt fault currents now available,—and are adequately safe to allow for future system growth.



Mr. J. Wesley Birch, Manager of Pitman Electric Co. at main switch board which is equipped with BUSS Hi-Cap and FUSETRON dual-element fuses.

WITH FUSES, SAFE PROTECTION REMAINS SAFE WITHOUT MAINTENANCE OR RECALIBRATION COSTS

After years of inactivity, fuses will provide the same safe, accurate protection if called upon to open as they would on the day installed.

Fuses have no hinges, pivots or contacts to stick or get out of order. Dust, fumes, corrosion or age cannot increase the capacity of fuses or lengthen their blowing time.

For more information:

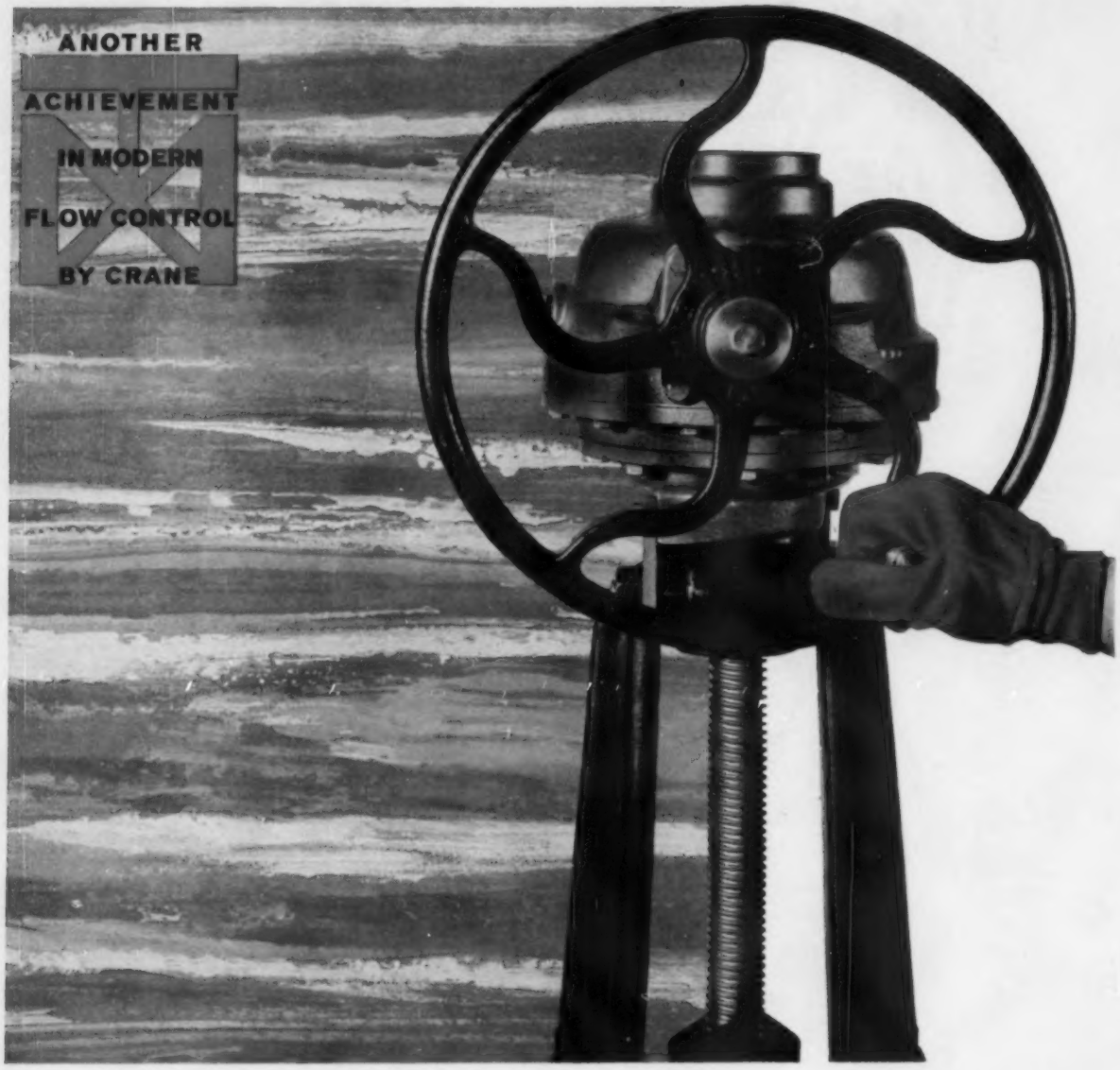
Fusetron dual-element fuses.....write for bulletin FIS
BUSS Hi-Cap fuses.....write for bulletin HCS

BUSSMANN MFG. DIVISION, *McGraw-Edison Co.*
University at Jefferson, St. Louis 7, Mo.

If you need fuses with long time-lag to prevent needless blows, plus 200,000 amp interrupting capacity, plus extreme current-limitation—use **BUSS LOW-PEAK** fuses.
Ask for BUSS bulletin LPCS.

561

For more facts circle 514 on Reply Card



one hand can stop a river

CRANE'S NEW CONVERTO-GEAR OPERATOR

gives you torque enough to tame a torrent. In a matter of minutes, you can power up a wide range of Crane iron and steel gate valves: OS&Y's with ball-bearing or split yokes, rising and non-rising stem types with stems up to 2½-inch diameter.

Take your choice of two styles—horizontal or vertical wheel—both with spiral-cut bevel gears of carburized alloy steel yielding a 4.11 to 1 ratio in manual operation, or with portable air or electric power. Mechanical efficiency is over 95%, with three sets of ball bearings to cut friction, and the entire self-lubricating unit is rugged and weatherproof.

The kit is complete, for simple installation in less than 30 minutes—or your Crane Distributor can take your order now for new valves already fitted with the power-packed Converto-Gear Operator.

For complete details contact your Crane Distributor or write Crane Co., Industrial Products Group, 4100 S. Kedzie Ave., Chicago 32, Ill. In Canada, Crane, Ltd., 1700 Beaver Hall Square, Montreal.

at the heart of home and industry

CRANE

valves
piping • electronic controls
plumbing and heating
air conditioning

For more facts circle 515 on Reply Card

BULLETINS

JUST RELEASED and OF IMMEDIATE PLANT INTEREST

LIGHTING

Lighting for Industry—This 16-pp lighting guide (BLBS Form B-570) explains in non-technical language what's behind the higher lighting levels recommended for industry. Includes data on recommended foot-candle levels, discussion of quality factors in plant lighting, explanation of benefits resulting from properly lighted plant, and case histories of typical plants where these lighting benefits have paid off. Better Light Better Sight Bureau.
▲ For a copy, circle 101 on Post Card

New Light, More Light—High efficiency fluorescent lights designed for maximum economy and most light for the money are featured in this product bulletin. Includes eye sensitivity curve, comparative output chart and technical data. Westinghouse Electric Corp.
▲ For a copy, circle 102 on Post Card

General Purpose Floodlight—Bulletin GEA-6435C contains photometric data on general purpose floodlights for outdoor commercial and industrial applications. Describes product features and illustrates maintenance and servicing procedure. General Electric Co.
▲ For a copy, circle 103 on Post Card

Improved Luminaire—Featured in this engineering lighting report is company's Decolite luminaire which combines higher levels, comfort, good design and economy of operation. Holophane Co., Inc.
▲ For a copy, circle 104 on Post Card

MATERIALS HANDLING

Continuous Flow Systems—Illustrated and described in 32-pp Catalog 860 are typical installations of continuous flow materials handling systems in variety of industries. Covers roller conveyors, wheel conveyors, belt conveyors, live roller conveyors, chain conveyors, overhead trolley conveyors, elevating conveyors, sheet metal and roller spirals. Mathews Conveyor Co.
▲ For a copy, circle 105 on Post Card

Conveyor Systems—Engineered conveyor systems, and package and bulk handling equipment are illustrated and described in 56-pp Catalog 70. Covers trolley conveyors, wheels, sprockets and roller turns, belt and slat conveyors, package handling conveyors, wire-mesh belt conveyors, roller conveyors, gravity roller and wheel conveyors, table-top chain conveyors, barrel handling conveyors, drum rotators and upenders, pin and spindle type conveyors, cross-bar conveyors. Conveyor Systems, Inc.
▲ For a copy, circle 106 on Post Card

Integrated Conveyor System—Illustrated and described in 22-pp Bulletin 112 is a conveyor system with "off-the-shelf" units that fit together as integrated components. Describes three plans for selection and ordering of the pre-engineered, pre-fabricated components to suit individual needs and includes detailed specifications. Standard Conveyor Co.
▲ For a copy, circle 107 on Post Card

Pneumatic Conveyors—Detailed selection data on pneumatic conveying systems is presented in 8-pp Bulletin 228. Shows all standardized components, capacities, horsepower required. Sprout, Waldron & Co., Inc.
▲ For a copy, circle 108 on Post Card

Conveyor Ideas—Pictures and story captions about recent conveyor installations are presented in this product bulletin. Covers a broad range of package conveyor solutions to problems of lowering handling costs. Standard Conveyor Co.
▲ For a copy, circle 109 on Post Card

Trolley Conveyors—What a trolley conveyor can do to reduce manufacturing and handling costs—and how to select the right one for any requirement—are topics considered in 58-pp Book 2730. Includes examples of typical installations, as well as informatiom for design of a trolley conveyor system, tables of materials, dimensions, specifications, drawings. Link-Belt Co.
▲ For a copy, circle 110 on Post Card

Hoists for Industry—Illustrated and described in 8-pp Catalog 601 are lever, electric, air, hand chain hoists and trolleys. Includes detailed selection tables giving rated capacities and other data. Duff-Norton Co.
▲ For a copy, circle 111 on Post Card

Electric Chain Hoists—Standard specifications for electric chain hoists are presented in 8-pp Booklet HMA-400. Lists points to consider in choosing a hoist for a particular application. Hoist Manufacturers Association, Inc.
▲ For a copy, circle 112 on Post Card

Lifting Clamps—Detailed information on safety snap lock lifting clamps for a variety of industrial lifting operations is presented in this 22-pp bulletin. Specifications, photos and diagrams of various models in the line are included. J. C. Renfroe & Sons, Inc.
▲ For a copy, circle 113 on Post Card

Narrow Aisle Trucks—Illustrated and described in 16-pp Catalog 2365 LK are narrow aisle electric trucks and hydraulic hand pallet trucks. Illustrates typical applications and includes specifications and dimensional diagrams. The Raymond Corp.
▲ For a copy, circle 114 on Post Card

Lift Trucks—Illustrated and described in 16-pp Catalog BU-660 are lift trucks in the 2,000 to 10,000 lb capacity ranges. Design, engineering construction and operation features of the lift trucks, their components and their power plants are detailed. Allis-Chalmers Mfg. Co.
▲ For a copy, circle 115 on Post Card

Truck Upkeep Costs—This cost-analysis booklet is based on interviews with typical users of the three-wheeled Trucksters in a variety of applications in plants and on the street, carrying the workman and his materials to the job. Each case history lists number of trucks used, type of work, length of service and gives breakdown of total mileage, all costs. Cushman Motors.
▲ For a copy, circle 116 on Post Card

Bulk Handling System—This bulletin discusses the filling, shipping, storing and discharging of Tote bins, heart of the Tote System. Touches upon benefits of in-plant and inter-plant handling of bulk materials. Tote System, Inc.
▲ For a copy, circle 117 on Post Card

FANS, VENTILATION

Roof Ventilator—Direct drive centrifugal roof ventilators are described in 8-pp Bulletin 4104. Illustrates and describes design features and operating characteristics and includes selection and rating tables. American-Standard Industrial Div.
▲ For a copy, circle 118 on Post Card

Heating, Ventilating Equipment—Eight-pp Bulletin DB-7-102 contains illustrations, ratings, specifications and descriptive data on direct-connected airfoil centrifugal fans, propeller and centrifugal power roof ventilators, wall-mounted and square panel propeller fans, and steam, hot water, electric and gas-fired unit heaters. Ilg Electric Ventilating Co.
▲ For a copy, circle 119 on Post Card

Postage-free Reader Service Cards for your convenience in ordering these bulletins are provided on pages 217-218. You may also use the post cards for ordering any literature mentioned in the ads.

Air Distribution Equipment—Eight-pp Condensed Catalog F-4471-8 features sidewall and ceiling air diffusers in a wide range of sizes and designs. Dimensional data and mounting diagrams included. Barber-Colman Co.
▲ For a copy, circle 120 on Post Card

Rotary Positive Blowers—How a lobe-type, rotary positive displacement blower delivers a metered amount of air against varying pressures with a minimum amount of friction is explained in 12-pp Bulletin S-32-A. Diagrams and charts illustrate blower design, dimension and performance data for vertical and horizontal models. Sutorbilt Corp.
▲ For a copy, circle 121 on Post Card

PRE-COOLERS FOUND CONTRARY TO UNIFORM PLUMBING CODE

Sponsors of

UPC

UNIFORM PLUMBING CODE

Resolution #2, Passed October 7, 1960
31st Annual Conference

WESTERN PLUMBING OFFICIALS ASSOCIATION

Whereas the Western Plumbing Officials Association has worked continuously with the industry to improve plumbing fixtures, equipment, and appliances and

Whereas acceptable standards are found frequently to be incomplete or lacking in complete details to serve as a complete guide for manufacture of plumbing products and

Whereas requests to the industry to discontinue a practice in construction is as effective as legislation or changes to a standard, now

Therefore be it resolved the manufacturers of refrigerated drinking fountains be and hereby are requested to discontinue the practice of installing cooling fins in the drain lines of coolers for pre-cooling purposes. Such obstructions being contrary to the provisions of the Uniform Plumbing Code.

NEW SUNROC COOLERS WITH PACKAGED COOLING have no pre-cooler.

Get complete details on PACKAGED COOLING in these new SUNROC Coolers:

NAME_____

FIRM_____

ADDRESS_____

CITY_____

ZONE____ STATE_____

☐ Wall-Hung Coolers
☐ Flush-to-Wall Coolers
☐ Remote Coolers
☐ Column Mounted Coolers

SUNROC CORPORATION

GLEN RIDDLE, PA. • In Canada—Frigidaire of Canada

For more facts circle 516 on Reply Card

BULLETINS

(Begins on page 21)

CONSTRUCTION

Wood Building Products—This 1961 building and industrial products catalog, about 48 pp, presents features, application suggestions, specification data and pertinent information on the handling and installation of wood building materials. Book is indexed and handsomely illustrated with drawings and photos, many in color. Separate sections cover decorative plywoods; doors; fir and other plywoods; siding and sheathing. Georgia-Pacific Corp.
▲ For a copy, circle 123 on Post Card

Laminated Architectural Glass—Methods and materials for installing laminated glass are described in this 8-pp bulletin. Explains how layer of polyvinyl butyral plastic sandwiched between two sheets of glass, bonded permanently under heat and pressure, produces clear, resilient and shatter-resistant glazing material. Monsanto Chemical Co.
▲ For a copy, circle 124 on Post Card

Asbestos-Cement Panels—This 28-pp architectural, engineering and data manual, File No. 19-D, features asbestos-cement faced sandwich panels for interior or interior-exterior use. Contains data and specifications on such applications as curtain-wall systems, roof deck and window wall construction, and interior partitions with aluminum and steel batten systems, wood framing and standard mouldings. National Gypsum Co.
▲ For a copy, circle 125 on Post Card

Non-Shrink Mortar—The value of non-shrink mortar in new construction is discussed in Bulletin E-38. Operations covered include waterproofing walls and joints, grouting building columns, machinery and anchor bolts, caulking sewer pipe joints, patching defects in concrete, others. The Master Builders Co.
▲ For a copy, circle 126 on Post Card

Why Model the Plant—The whys' and hows' of using scale models as an engineering tool in construction projects are outlined from preliminary design through erection and equipment installation in this 6-pp booklet. Covers preliminary studies and use of "Do it yourself" kit, basic model, piping design, use of material take-off. Industrial Models, Inc.
▲ For a copy, circle 127 on Post Card

INSTRUMENTS, CONTROLS

Multi-Point Controllers—Eight-pp Instrument Section 52 describes a multi-point controller for two-position control of up to ten industrial processes; three-position control of five processes; constant control of a single process; manual balance indication of exact process conditions at each point controlled. Thermo Electric Co., Inc.
▲ For a copy, circle 128 on Post Card

Temperature Controls—Brief descriptions and specifications for 17 different types of temperature controls are given in 8-pp Catalog MC-203. Covers Thermoswitch units, miniaturized local controls, fire and overheat detection models, snap action controls, and electronic controllers. Fenwal Inc.
▲ For a copy, circle 129 on Post Card

Computer Control—Applications of computer controls in a variety of industrial processes, from petroleum and chemicals through power, cement and research, are detailed in this 12-pp bulletin. Describes the RW-300 digital computer designed specifically for process control. TRW Computers Co.
▲ For a copy, circle 130 on Post Card

Automation System—Bulletin G-2500, 16-pp, explains how drive speeds of machines and processes can be automatically controlled and regulated by simple pneumatic instrumentation. Applications in controlling liquid level, line pressure, process temperature, constant flow, steam pressure and motor loading illustrated. Reliance Electric and Engineering Co.
▲ For a copy, circle 131 on Post Card

Automated Material Control—Detailed in 8-pp Bulletin GEA-7130 is an automatic system for handling of incoming materials, work in progress or finished product distribution. Explains tie-in between material handling automation and related data processing functions and describes five major material handling functions performed—identify, dispatch, store, recall and deliver. General Electric Co.
▲ For a copy, circle 132 on Post Card

Definite Purpose Controls—Eight-pp Bulletin GEA-7316 described definite purpose contactors and starters for air conditioning and refrigeration. Outline drawings and dimensions are included along with load data, coil data, outline numbers, wiring diagrams, current ratings. General Electric Co.
▲ For a copy, circle 133 on Post Card

Climate Control Station—Functions, components and benefits of Electronic control centers are described in 8-pp Form F-8031-1. Plant engineers concerned with automatic temperature control systems can obtain information on graphic panel, Selectronic and identification control centers from this brochure. Remote temperature indication, recording and control point adjustment by electric and electronic instruments are described. Also discussed are additional optional functions, such as control of lighting. Barber-Colman Co.
▲ For a copy, circle 134 on Post Card

Humidity Control—Effects of uncontrolled humidity on equipment and material and the need for humidity measurement and control are detailed in 68-pp Catalog 661. Typical and specially-tailored hygrometer systems are illustrated and described as well as electrical hygrometer instrumentation, including sensing elements, indicators, controllers, recorders etc. Hygrodynamics, Inc.
▲ For a copy, circle 135 on Post Card

Sight Flow Indicators—Flapper and rotary types of sight flow indicators are described in Bulletin 18W. Covers constructions details, dimensions, operating limits and specifications. Schutte and Koerting Co.
▲ For a copy, circle 136 on Post Card

HEATING

Heavy-Duty Heaters—This 12-pp brochure contains descriptions, technical data and application photos on combination oil-gas industrial heaters. Blower performance charts are included for each unit, from 280,000 to 1 million Btuh, as well as tables of dimensions, air handling capacities, heat exchanger area, motor horsepowers, additive cooling capacities and plumbing data. Diagrams show possible arrangements. Lennox Industries Inc.
▲ For a copy, circle 137 on Post Card

Indirect - Fired Heaters—Eight - pp Bulletin 400 describes indirect-fired heaters for gases, vapors, and liquids. Advantages of design and operation are detailed and general specifications and capacities listed, along with data on auxiliary equipment. Brown Fintube Co.
▲ For a copy, circle 138 on Post Card

Storage Tank Heaters—Hot water storage tank heaters, including steel, cement-lined, copper-lined and solid copper-silicon, as well as heating elements for these tanks are illustrated and described in 16-pp Catalog 602. Includes piping diagrams, engineering data and capacity charts. Old Dominion Iron & Steel Corp.
▲ For a copy, circle 139 on Post Card

Reader Service Cards for ordering bulletins are on pages 217 and 218.

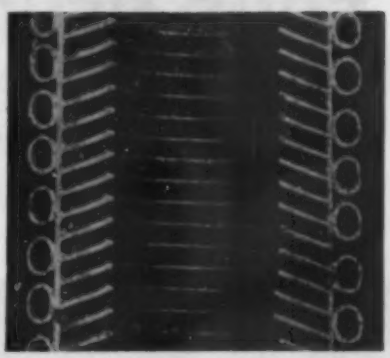
Fired Immersion Heaters—Details on fired immersion heaters for heating asphalt, Bunker C oil, and other liquids in tanks for loading, pumping, blending or storage are presented in Bulletin 410. Table of dimensions and specifications included. Brown Fintube Co.
▲ For a copy, circle 140 on Post Card

MAINTENANCE

Coatings and Compounds—Characteristics and applications of a synthetic rubber compound for all types of sealing and caulking jobs, and a line of protective coatings for industry are described in DEL Bulletin 105. Performance data and suggestions for applying are given along with a chemical resistance chart. David E. Long Corp.
▲ For a copy, circle 141 on Post Card

Floor Resurfacer—Described in this 6-pp bulletin is a corrosion- and abrasion-resistant floor resurfacer for applications where chemical spillage and heavy steel wheel traffic creates a maintenance problem. Typical installations, results of physical tests are listed, along with chemical resistance table. Masury-Young Co.
▲ For a copy, circle 142 on Post Card
(More Bulletins on page 219)

WHY COOLERS MUST BE SPECIFIED BY GPH WITHOUT PRE-COOLING



Cut-away section of actual pre-cooler

- Pre-cooler fins collect foreign matter from bubbler spill water.
- Fins become clogged; cold drain water cannot flow over and around fins.
- Cold spill water flows directly down drain, does no pre-cooling.
- Satisfactory under lab conditions, pre-cooler clogs in actual use, loses its pre-cooling efficiency. Result—cooler capacity cut as much as ½.

New SUNROC Coolers with PACKAGED COOLING have no pre-cooler. Larger refrigeration system produces all the rated capacity—needs no pre-cooler boosting. Unless it's a New SUNROC with PACKAGED COOLING, a water cooler must be specified by capacity without pre-cooling. Only then will you get all the GPH you specify.

Send non-proprietary specification form on how to specify without pre-cooling.

NAME_____

FIRM_____

ADDRESS_____

CITY_____

ZONE_____ STATE_____

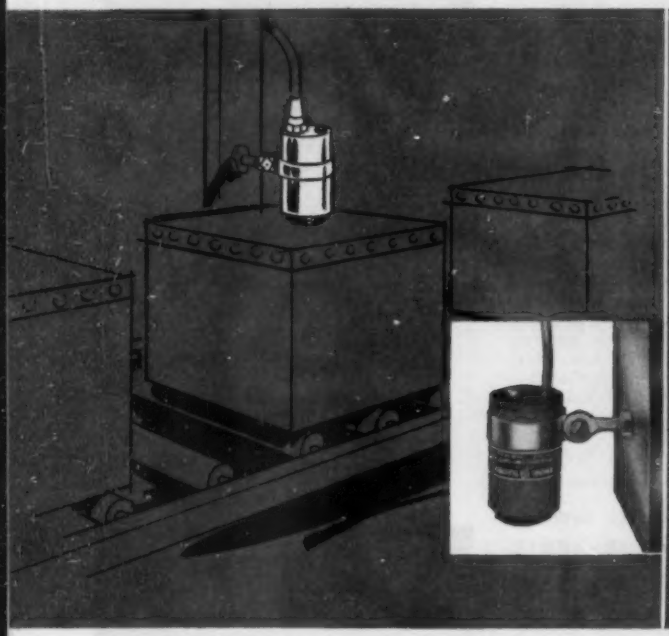
SUNROC CORPORATION

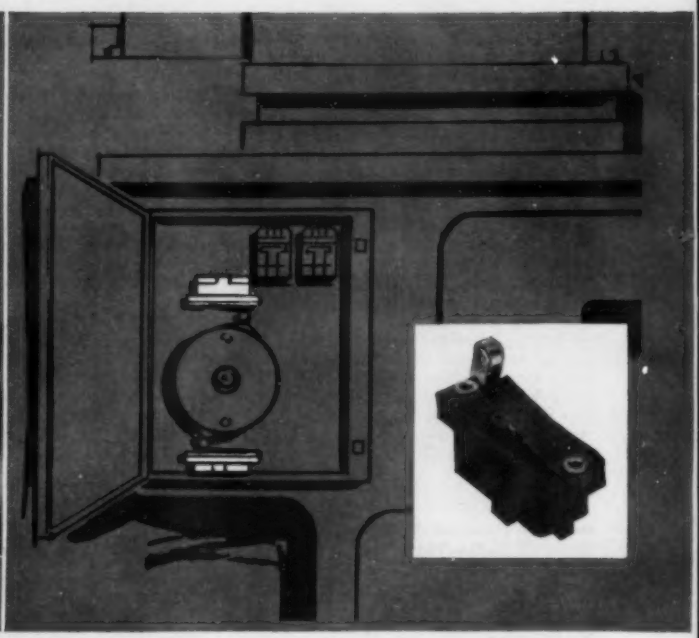
GLEN RIDDLE, PA. • In Canada—Frigidaire of Canada

For more facts circle 517 on Reply Card

From General Electric . . .

FOUR NEW LIMIT SWITCHES FOR HARD-TO-SOLVE APPLICATIONS





Priced lower than any comparable switch . . .

NEW PROXIMITY LIMIT SWITCH DETECTS MAGNETIC OR NON-MAGNETIC METAL

Now General Electric announces a proximity switch that gives the maximum reliability of an *all-transistorized* circuitry (no vacuum tubes), self-contained in the operating head. The switch senses ferrous material up to one inch, and even non-magnetic metal up to one-half inch. No shielded cable is required. No physical contact is required to actuate this limit switch, so there are no arms, levers, or shafts to wear out. The proximity switch is encapsulated to prevent entry of coolants or contaminants, and will even operate under water. All these features are combined in the lowest priced proximity limit switch available today.

SPECIFICATIONS

Maximum repetitive accuracy: .005 inch
Minimum differential: .01 inch
Operating time: 20 milliseconds

Temperature: Operates in ambients to 150 F
Application: Can be used with magnetic devices or static control
Sensing head rating: Input—30 volts d-c; Output—30 volts d-c, 250 milliamperes
Publication: GEA-7318

For fast response where space is limited . . .

NEW PRECISION SNAP-ACTION LIMIT SWITCH OFFERS HIGH ACCURACY

General Electric's new precision snap-action limit switch is designed to bridge the gap between the very small and sometimes fragile limit switches, and larger, enclosed limit switches. If space is limited . . . if you don't need the extreme sensitivity of the small switches . . . and if you *do* need heavier-duty operation with good repetitive accuracy and fast response . . . the precision snap-action limit switch is the answer for your application.

The limit switch is available with plunger or roller lever operators. Both types utilize a four-point contact structure (no common connections) in single-pole, double-throw forms, for more flexible circuit applications.

SPECIFICATIONS

Contact arrangement:
SPST—1 NO or 1 NC
SPDT—1 NO-1 NC

Ratings:
AC—up to 40 amps make, 15 amps break; DC—up to 2 amps "make" and break on single-throw forms with .040 gap; Single throw switches are suitable for ½ hp, 115 V or 230 V, a-c. All forms available from 110-600 volts

Publication: GEA-7319

Proximity and Precision Snap-action Switches Added to General Electric Line

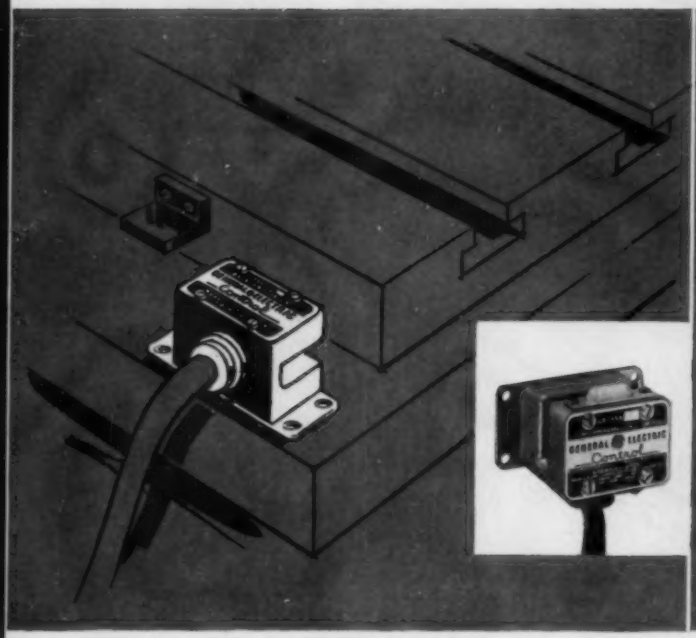
Limit switches are often called the "weak link" in industrial control. But introduction of four new, precision limit switches by General Electric has helped solve this problem. Vane- and magnet-operated limit switches, introduced in 1960, have virtually eliminated mechanical failures on many applications.

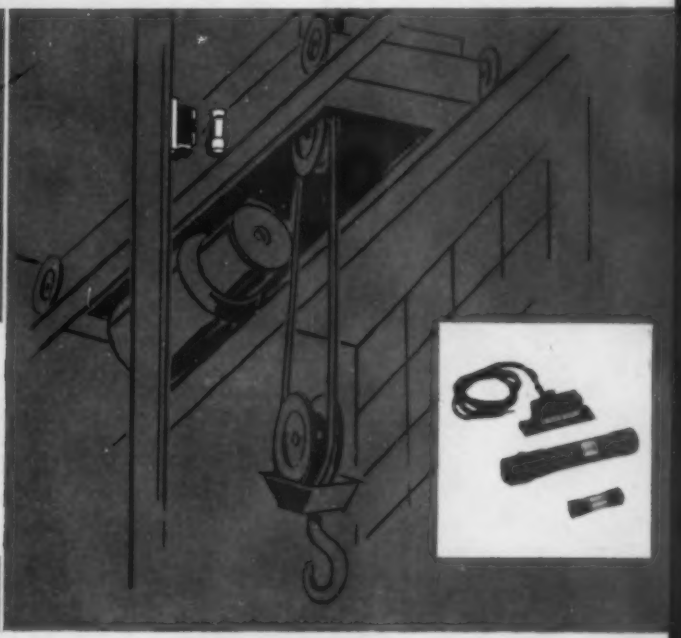
Now G-E announces a new low-priced proximity switch that detects non-magnetic as well as magnetic metal with outstanding reliability. And for high accuracy, fast response requirements where space is limited, General Electric offers its new open, precision, snap-action limit switch. For more information, call your G-E sales engineer or write Section 811-21, General Electric Co., Schenectady N. Y. for publications listed below.

You Get MEASURABLE ADVANTAGES WITH GENERAL ELECTRIC CONTROL

Progress Is Our Most Important Product

GENERAL ELECTRIC





For leverless operations . . .

NEW VANE-OPERATED LIMIT SWITCH IS ENCAPSULATED FOR LONGER LIFE

The completely encapsulated design of the new vane-operated limit switch seals out liquids, dirt, and metal chips. The switch has no arms, levers, or shafts to fail. The result is extremely long life. For example, with small a-c relays, the expected operating life is 30 to 50 million operations. The switch is actuated by passage of a separate ferrous vane through a slot. There is no physical contact, and the only moving parts are contacts which flex slightly. Price is only slightly higher than conventional limit switches.

SPECIFICATIONS

Response time:	.001 second
Repetitive accuracy:	.0025 inch or less
Contact rating:	0.75 amp "make" at 115 volts a-c 0.2 amp carry and break at 115 volts a-c
Differential:	⅛ inch (NO contact) ¼ inch (NC contact)
Contact arrangements:	1 NO or 1 NC
Publication: GEA-6995	

Where operating path is variable . . .

NEW MAGNET-OPERATED SWITCH OPERATES UP TO 4 INCHES FROM MAGNET

General Electric's new magnet-operated limit switch offers the features of the vane-operated switch, plus the ability to detect objects moving in erratic paths. The switch is operated by passage of a permanent magnet near the face of the switch. The larger of two available magnets can be approximately four inches from the switch, and still actuate it. A wide variety of mounting arrangements is possible: Either switch or magnet may be mounted on moving part, or both may be stationary with vane passing between.

SPECIFICATIONS

Response time:	.001 second
Repetitive accuracy:	With ⅝ inch dia. magnet—±.003 inch With 1⅛ inch dia. magnet—±.007 inch
Contact rating:	0.75 amp "make" at 115 volts a-c 0.2 amp carry and break at 115 volts a-c
Contact arrangement:	1 NO
Publication: GEA-7305	

For more facts circle 518 on Reply Card

WHO ELSE BUT CUTLER-HAMMER GIVES YOU ALL THESE FEATURES?

- Quick and safe maintenance
- All front connections
- Tough baked enamel finish
- Completely safe wiring troughs
- Add options . . . no crowding
- Vertical bus silver plated
- Quick latch door fasteners
- Five padlock locations
- 100% interchangeability
- Positive off-power test position
- Modular construction

CONTROL

Now! Cutler-Hammer Unitrol in two new shallow depths!

Get more compactness, more flexibility in motor control centers plus Cutler-Hammer dependability and safety

With Unitrol, you eliminate the high cost of mounting and wiring individual starters, as well as using far less space. Unitrol gives you flexibility, too . . . easy to change starters to fit needs and expand without disturbing other starter units. The two new shallow depths (15" and 12") make Unitrol practical even on catwalks or tunnels. Unitrol's modular design lets you put as many as 8 Size 1 starters in a single section and still leave room for many options.

But, probably more important is the safety factor built into Unitrol—safety for the men and machines. For instance, you can *lock* each unit in maintenance position for complete safety. Look at the features at the left for some of the extra values in Unitrol.

What's new at Cutler-Hammer? You can see the new spirit and vitality in a flood of new products and product improvements. Plant capacity has been increased. We've added new engineering talent to increase efficiency. Everywhere you look, you can see that we're ready to help you meet the challenge of the years ahead. Get the inside story from the Cutler-Hammer sales office nearest you.

NEW! FREE! BOOKLET: The "Motor Control Center Handbook" gives you practical facts on selecting the proper control as well as estimating for future needs. Send for Pub. LJ-1-J274 now!

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.

CONTROL

For more facts circle 519 on Reply Card

For more facts circle 520 on Reply Card

Youngstown Foundry & Machine cuts heating cost

Startling savings of $9,892 in fuel costs in one year's operation – plus a wonderful new kind of heating comfort – are big reasons Perfection Schwank *Gas* Infra-Red Heaters rate high with Youngstown Foundry and Machine Company, Youngstown, Ohio. Listen to these comments:

"Heating a 60 year old building like this is a tough job," states James Paumier, Plant Superintendent, "but this Perfection Schwank *gas* system gives us a constant and comfortable 65° temperature, drastically cuts our fuel cost and requires practically no maintenance."

Wayne Thew, Foreman, exclaims, "I've been here for 20 years and Perfection Schwank *Gas* Infra-Red is far superior to any other heating system we've tried. Castings and machinery are *always* the same temperature, eliminating expansion and contraction problems and making

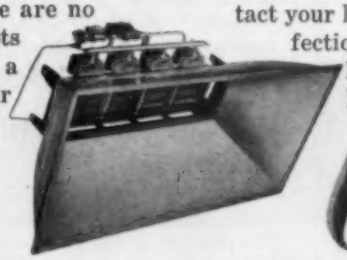
Part of the 41,160 square feet of floor space at Youngstown Foundry and Machine . . . all heated by Perfection Schwank Gas Infra-Red Heaters.

$9,892 with Perfection Schwank Gas Infra-Red Heaters

tolerances much easier to meet."

States Joseph Sagy, Plane Operator: "Since we've had these *gas* Infra-Red heaters, there are no drafts, no hot and cold spots . . . in every way they're a big improvement over our previous heating system.

Perfection Schwank *Gas* Infra-Red Heaters give you all of the advantages of modern *gas* heat—high efficiency . . . precise control . . . speed . . . safety . . . cleanliness . . . economy . . . as well as dependability of supply.



Heat better for less with Perfection Schwank *Gas* Infra-Red Heaters. For complete information, contact your local Gas Company or write to Perfection Division of Hupp Corporation, licensee of American Infra-Red Radiant Co., 1135 Ivanhoe Road, Cleveland 10, Ohio.

American Gas Association.

FOR INDUSTRIAL HEATING GAS IS GOOD BUSINESS!

Approved by A.G.A., Underwriters, C. G. A. and C. S. A.

Under Schwank U. S. Patents 2,775,294 and 2,870,830 and pending applications.

FILLED TEFLON* BEARINGS

Chempro Filled-Teflon Bearings are tougher, harder, more wear-resistant and less subject to thermal expansion with the addition of specific filter compounds to virgin Teflon. Ideal for pumps, mixers, reactors and similar equipment where a chemically inert, non-corrosive, non-contaminating and non-adhering bearing material is a must.

Chemical & Power Products offers a complete Filled-Teflon Bearing service, including Chempro Finished Bearings either Pressed in Housings or without Housings, or Chempro Filled-Teflon Molded Tubes for machining bearings in your shop. Complete machining instructions furnished.

CHEMPRO FILLED TEFLON STYLES

FM-2	Glass-Filled Teflon
FM-3	Carbon-Filled Teflon
FM-4	Glass and Carbon-Filled Teflon
FM-8	Graphite- and Zircon-Filled Teflon
FM-9	Molybdenum Disulfide and Glass-Filled Teflon
FM-10	Mica- and Glass-Filled Teflon

Write for Bulletin CP-558.

*duPont trademark

CHEMICAL & POWER PRODUCTS, Inc.

7 Broadway, New York 4, N. Y.

For more facts circle 521 on Reply Card

BACKTALK AND FORETHOUGHTS

Plant Spring Cleaning

PLANT ENGINEERING:

"As a regular reader of your magazine, I would like to solicit your assistance on a current problem we have at our plant. We intend to clean and repaint the interior of our plant this summer. This will involve removing dirt and grime from all overhead construction such as pipes, roof joists, conveyor track, etc.

"Is there any manufacturer who has a method or a product that will permit us to do this cleaning economically? This operation, if done by hand wiping, etc. can cost a small fortune.

"I would appreciate any information you could supply to me." *August F. Katzke, Plant Engineer, Toro Manufacturing Corp., Windom, Minn.*

■ Steam cleaning or a local plant-cleaning service may be the answer here and we have forwarded some information which we think might be helpful. Meanwhile, copies of several articles that appeared in PLANT ENGINEERING, will give Mr. Katzke some more ideas on the subject.—*Editors.*

Like Electric Truck Series

PLANT ENGINEERING:

"Please forward to the writer's attention and at your earliest convenience, tear sheets on the article 'Why Electric Trucks at Crane? In-Plant Survey Dictates Choice,' as published in the March, 1961 issue of your magazine." *W. D. Geisser, Vice President, Production, Baltimore Air Coil Company, Inc., Baltimore, Md.*

PLANT ENGINEERING:

"We read with much interest the article entitled 'Why Electric Trucks at Crane?' which appeared in the March, 1961 issue of PLANT ENGINEERING, and noted the fact that two more articles relating to the subject are forthcoming in the near future.

"To kill three birds with one stone, we wonder if it is possible at this writing to arrange for 10 reprints of each of the three articles, submitting the invoice therefore at your earliest opportunity." *H. C. Christensen, Management Engineer, Allied Chemical Corporation, New York, N.Y.*

Radiation Survey Instruments

PLANT ENGINEERING:

"If tearsheets are available I would appreciate receiving two copies of the article 'Radioisotopes Primer' in the November issue of PLANT ENGINEERING. Kindly include the radioisotopes bibliography mentioned at the end of the article.

"Articles of this type are most helpful in understanding how survey instruments suitable to a particular application may be chosen intelligently." *Vincent Grippi, Design Engineer, Alexander Potter Associates, New York, N.Y.*

■ Tearsheets and the bibliography have been sent to Mr. Grippi, with our compliments.—*Editors.*

Technical Training Courses

PLANT ENGINEERING:

"We would like to have more specific information about the DeVry Training Program.

"We would particularly like to see some sample lessons for basic electricity, electric control circuits and basic electronics. We are also interested in getting some details regarding the method of payment; that is, does the student pay for each lesson as he orders it or would advance payment for the entire course of 17 lessons (basic electricity) be required?

"Upon receiving this information, we will make a survey at this plant to determine how many of our electrical maintenance personnel would be interested in this type of program. I will appreciate any information that you can furnish that would answer these questions." *J. W. Cunningham, Training Manager, Reynolds Metals Co., Listerhill, Ala.*

PLANT ENGINEERING:

"Your February, 1961 issue contains an article on 'Electronic Training for Maintenance Men.'

"I would like to have more information about this training course for possible use at our plant in Anderson, Ind. Descriptive information giving more details of the course will be appreciated." *Russell J. Emmons, Industrial Relations Manager, Philadelphia Quartz Company, Philadelphia, Pa.*

PLANT ENGINEERING:

"The article in PLANT ENGINEERING, February, 1961, entitled 'Electronic Training of Maintenance Men,' is of very much interest to us. Actually, our maintenance men require electrical as well as electronic training, which I notice are courses available from DeVry. Would you please give us more information concerning pos-

WILL YOUR INSULATION PERFORM ACCORDING TO THE SPEC?

there's a foster protective system to help make sure it will

When the thermal-insulation specification includes the name "Foster," you're assured a protection system engineered to resist practically every condition the insulation can be expected to encounter. And only with the proper protection will the insulation perform efficiently.

There's no such thing as "or equal" when it comes to protecting your costly investment in insulation. Only the Foster system in the specifications can be relied on 100% to fill the bill.

Foster insulation-protection research has developed adhesive, vapor-barrier, and coating systems to meet virtually every conceivable thermal-insulation requirement. A letter or call outlining your problem will bring one or more Foster Bulletins which should contain an appropriate solution.

Thermal Insulation Protected By foster Fire Resistive Specifications

A symbol of fire resistive construction

foster COATINGS · SEALERS · ADHESIVES

BENJAMIN foster CO.
Division of Amchem Products, Inc.

4635 W. GIRARD AVE. • PHILA. 31, PA.

For more facts circle 522 on Reply Card

AUTOMATED
Hydral-60
PINCH VALVE
SYSTEMS

Controlled circuitry for any operating requirements

- The Masco-Grigsby Hydral-60 System consists of one or more pinch valves with a single automatically operated hydraulic pump.
- Hydraulic pump may be operated by electric motor or by air from normal plant supply system.
- Valves may be the same or different size.
- Valves in the system may be operated simultaneously or independently.
- Control valve may be manual or solenoid.
- Valves may be coordinated and interlocked with other plant equipment to automatically control tank levels, rate of flow, etc.
- Valves are self-supporting and may be operated in any position from horizontal to vertical.
- Valves may be independently controlled for normal or rapid closure.
- Valves may be held fully open, fully closed, or at intermediate positions.
- Remote control to meet individual requirements.
- Controls may be included for automatic emergency operation.
- 3" to 14" I.D. sizes, with 50, 100, and 150 psi line pressure ratings.
- Temperatures to 200° F.

WRITE FOR NEW CATALOG NO. 609
Manufacturing Division

MINE AND SMELTER SUPPLY CO.

3800 RACE STREET • DENVER, COLORADO
OFFICES AND AGENTS IN PRINCIPAL CITIES
For more facts circle 523 on Reply Card

BACKTALK—FORETHOUGHTS

sible training courses, both in our plant, and as extra-curricular training by the men themselves on their own time." *W. J. Sutherland, Plant Engineer, B. F. Goodrich Tire Company, Los Angeles, Calif.*

■ DeVry Technical Institute has training counselors in many cities throughout the country, so readers interested in receiving more information on the correspondence course offered by the Institute, will be able to get it at a local level. All inquiries are being forwarded to the Institute.—*Editors.*

We Thank You, Too!

PLANT ENGINEERING:

"Thanks for the PLANT ENGINEERING magazines which I have been receiving regularly, for they contain a vast source of information on products, processes, methods and other articles of interest to personnel in building and manufacturing trades. Your featured articles are comprehensive and have reader interest, so that I, as an individual, feel that I must read them or I shall have missed something of interest." *Peter Burch, Works Engineer, C. H. Wheeler Manufacturing Co., Ambler, Pa.*

Gremlins At Work!

PLANT ENGINEERING:

"Our circulated copy of the December, 1960 issue of PLANT ENGINEERING was robbed of the special article on 'Industrial Construction and the Plant Engineer.' An article which appears very interesting and worthwhile.

"The local burglar was clever though, he removed the whole series of articles and rebound the magazine so that by just leafing through, one would never notice its absence.

"If there are any reprints available, I would appreciate a copy." *C. E. Sunnergren, Project Manager, Pittsburgh Chemical Co., Neville Island, Pittsburgh, Pa.*

Well-Thumbed Magazine

PLANT ENGINEERING:

"As the issues of PLANT ENGINEERING complete their circulation through our plant, I have clipped the articles 'How To Plan Industrial Lighting' from the magazines for my files. Eventually, I hope to have the whole series.

"May I add that, in my opinion, your magazine is one of the best magazines being circulated through our department. Each issue is well thumbed by each engineer and many articles are saved from these issues." *W. Q. Ferguson, Cost Estimator, Plant Engineering Department, Aluminum Company of Canada, Ltd., Kingston, Ont., Canada.*

Industrial Construction

PLANT ENGINEERING:

"The special section on 'Industrial Construction and the Plant Engineer' in the December issue of PLANT ENGINEERING is in my opinion one of the most useful and interesting sets of articles ever published in a trade magazine.

"Since we file back copies of the magazine for future reference, I prefer not to clip the series for my own use. Will you, therefore, if available, send me a reprint of the entire section for my files.

"Many thanks for this and for other information which you have furnished in the past." *Richard R. Reinheimer, Plant Facilities Engineer, Stratos Division—Fairchild Engine & Airplane Corp., Bay Shore, L.I., N.Y.*

PLANT ENGINEERING:

"Please send me one reprint copy of the special section entitled 'Industrial Construction and the Plant Engineer.'

"I have just finished reading this section and you are to be congratulated on an excellent job. I hope that this is a forerunner of many more articles on this subject, which is in my opinion, of major importance to the plant engineer." *S. Woods, Plant Engineer, Resistoflex Corporation, Roseland, N.J.*

■ We have had many complimentary comments about this special section. Reprints of it are free for the asking. —*Editors.*

Calculator Request

PLANT ENGINEERING:

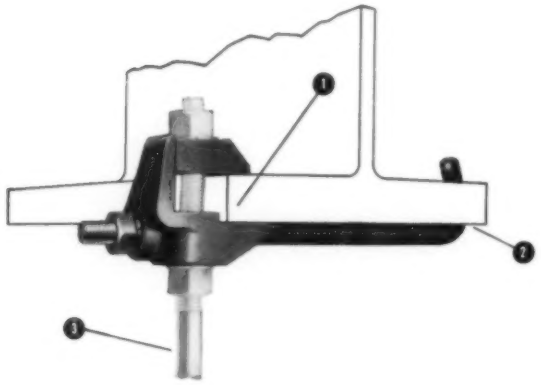
"Please accept my compliments for the first article in a series entitled 'How To Plan Industrial Lighting' by Willard Allphin. The first article is a beautiful thing, practically presented and easy to understand. I am looking forward to reading the subsequent articles in this series.

"There are numerous calculating slide rules available today for figuring all kinds of odd quantity calculations, etc., most of which are a useless nuisance in the desk drawer. However, I think that the Sylvania lighting calculator shown in the article will prove very useful. I would appreciate it if you would see that one of these calculators is sent to me." *Lane S. Jones, Plant Engineer, Hooker Chemical Co., Columbia, Tenn.*

You get extra features...at no extra cost ...when you specify Grinnell Beam Clamps!

GRINNELL G-CLAMP HANGER, FIG. 92 — 1. Ribbed, malleable iron casting for greater strength, impact resistance. 2. Full thread engagement. 3. Hardened steel cup-point set screw for good "grip" on beam. 4. Saddle swivels 360°.

GRINNELL MALLEABLE BEAM CLAMP WITH EXTENSION PIECE, FIG. 229 — 1. Tie rod locks clamp in place when nuts are tightened. 2. One jaw size fits all beam flanges up to 7". 3. Malleable iron extension piece.



GRINNELL SIMPLEX SIDE I-BEAM CLAMP, FIG. 265 —1. 1¾" maximum jaw opening will take large beam flange thickness. 2. May be attached to beam of any flange width by merely ordering hook rod of suitable length. 3. Load ratings of 1,740 lbs.

GRINNELL G-CLAMP HANGER, FIG. 86 — 1. Ribbed, malleable iron casting for extra strength. 2. Hardened steel cup-point set screw for good "grip" on beam. 3. Full thread engagement — casting drilled and tapped for rod, set screw.

You get *more* Clamp for your money from Grinnell! Reason: Grinnell's huge volume reduces production costs . . . lowers prices right into line with competitive hangers that offer you much less.

Know what else you get with Grinnell Clamps? Wider choice of types and sizes! Better quality control! Published rating for *all* Clamps with a safety factor of at least 5 to 1! Faster delivery may be had from nationwide warehouses!

What's more, you always get dependable field service by trained Grinnell personnel . . . no matter how far from the job site the sale was made! Grinnell Company, Providence 1, Rhode Island.

Remember, The Best Costs No More — from America's #1 Supplier of Pipe Hangers and Supports

Call your local Grinnell Distributor for pipe hangers, cast and malleable iron fittings, steel nipples, welding fittings, Grinnell-Saunders Valves, unit heaters — all made by

GRINNELL

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BONUS

from the Boiler

Selected exclusive sales territories available

POWER

Capital of the World . . .

THE TITUSVILLE-ATLAS

BONUS POWER means maintained high efficiency . . . longer life . . . less maintenance . . . more horsepower per total energy input. That's what you get when you install a complete TITUSVILLE-ATLAS unit, the only boiler with a patented wet back.

Wet-back design gives you maintained efficiency by eliminating back end refractories. *Result:* no down time for replacement.

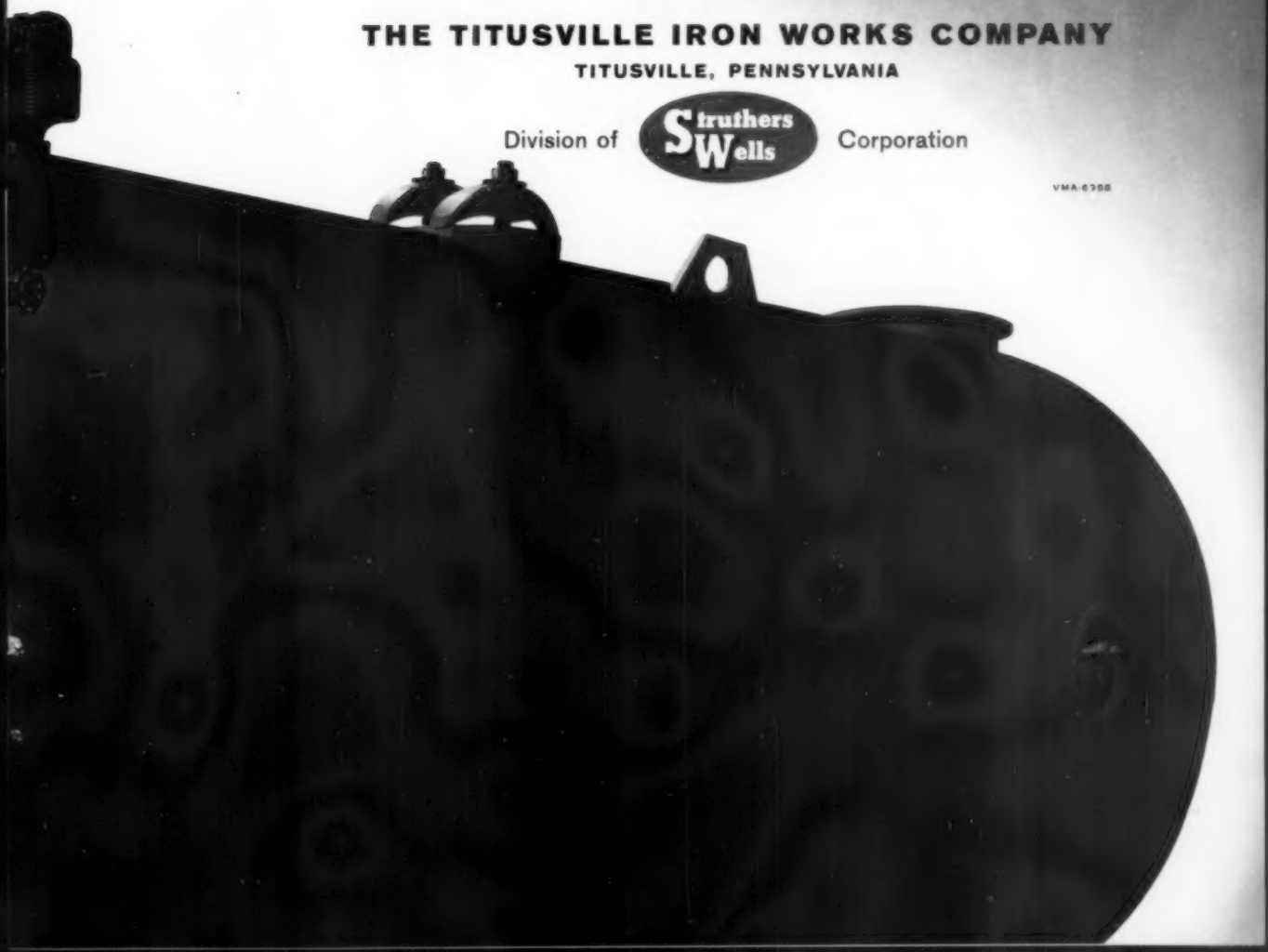
Larger furnace area permits reduced fan requirements. *Result:* lower operating costs. Get BONUS POWER. Specify TITUSVILLE-ATLAS.

THE TITUSVILLE IRON WORKS COMPANY

TITUSVILLE, PENNSYLVANIA

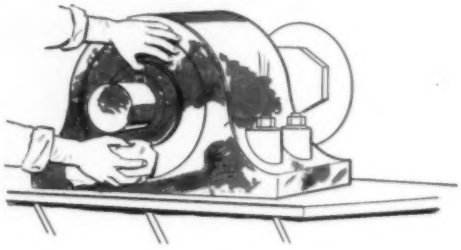
Division of Struthers Wells Corporation

VMA-6756



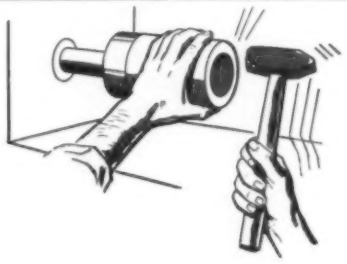
DISTRIBUTOR DAN, the SKF bearing man, says:
"Save this page and read these tips
BEFORE YOU CHANGE A BEARING!"

DON'T DISTURB A BEARING unless it's absolutely necessary. Most bearings give excellent service, year after year. When you remove a perfectly good bearing, you run the risk of damaging it or scoring the shaft or housing seat.

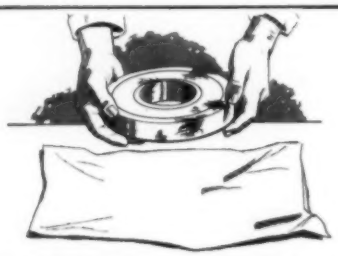


ALWAYS CLEAN THE HOUSING. Dirt and grime sometimes conceal tapped or unthreaded holes that enable you to use jack screws or knock-out pins to remove the bearing. Sometimes, bolts in the housing permit you to remove the bearing after you force out the shaft.

PRESSES AND PULLERS PREFERRED. Always use an arbor press or bearing puller to remove a bearing. They'll help you apply uniform pressure around tight-fitting rings. And never strike a bearing unless there's no alternative.



IF YOU MUST HIT A BEARING, don't strike its surface directly. Hold a sleeve against the correct ring. Aim the blow against a solid part of the ring, not against flanges. And aim the blow as squarely as possible to prevent cocking.



HANDLE EVERY BEARING CAREFULLY. Dismount it as though you plan to reuse it. Don't clean the bearing if it is to be examined for defects or signs of malfunctioning. Wrap it exactly as removed, otherwise you may destroy evidence of the operating conditions.

THE BEST BEARING BARGAINS BEGIN WITH THE SERVICES OF AUTHORIZED SKF DISTRIBUTORS.

SKF MOTION ENGINEERING

Advanced ball and roller bearing technology

For more facts circle 526 on Reply Card

MAGNETIC SEPARATION

Stop tramp iron damage before it costs you money
LET DINGS DO IT.

If you think this hunk of iron is beat up, you should see the other guy!

The "other guy" was a coal pulverizer. The unhappy owners learned the hard way that lazy tramp iron has no respect for costly, hard working machinery.

Any plant *without* a magnetic separator need only compare the cost in both repair and production delay—with the cost of a magnet.

Many plants *with* magnets that are over 10 years old have found that they can quickly write off the cost of a new, improved Dings unit...in savings. And, Dings has an electric or non/electric unit for installation in, on or above *any* processing or materials handling system.

Write for Catalog C-5000-B or see your Dings Man.

Dings

Here's just one way—
Dings magnetic pulleys, electro or permanent, are at work pulling unwanted iron out of everything from grain to cotton...to chemicals and molybdenum ore.

DINGS MAGNETIC SEPARATOR COMPANY
4766 West Electric Avenue, Milwaukee 46, Wis.

For over sixty years—Industry's Specialists for magnetic: separation . . . concentration . . . materials handling

PE-161

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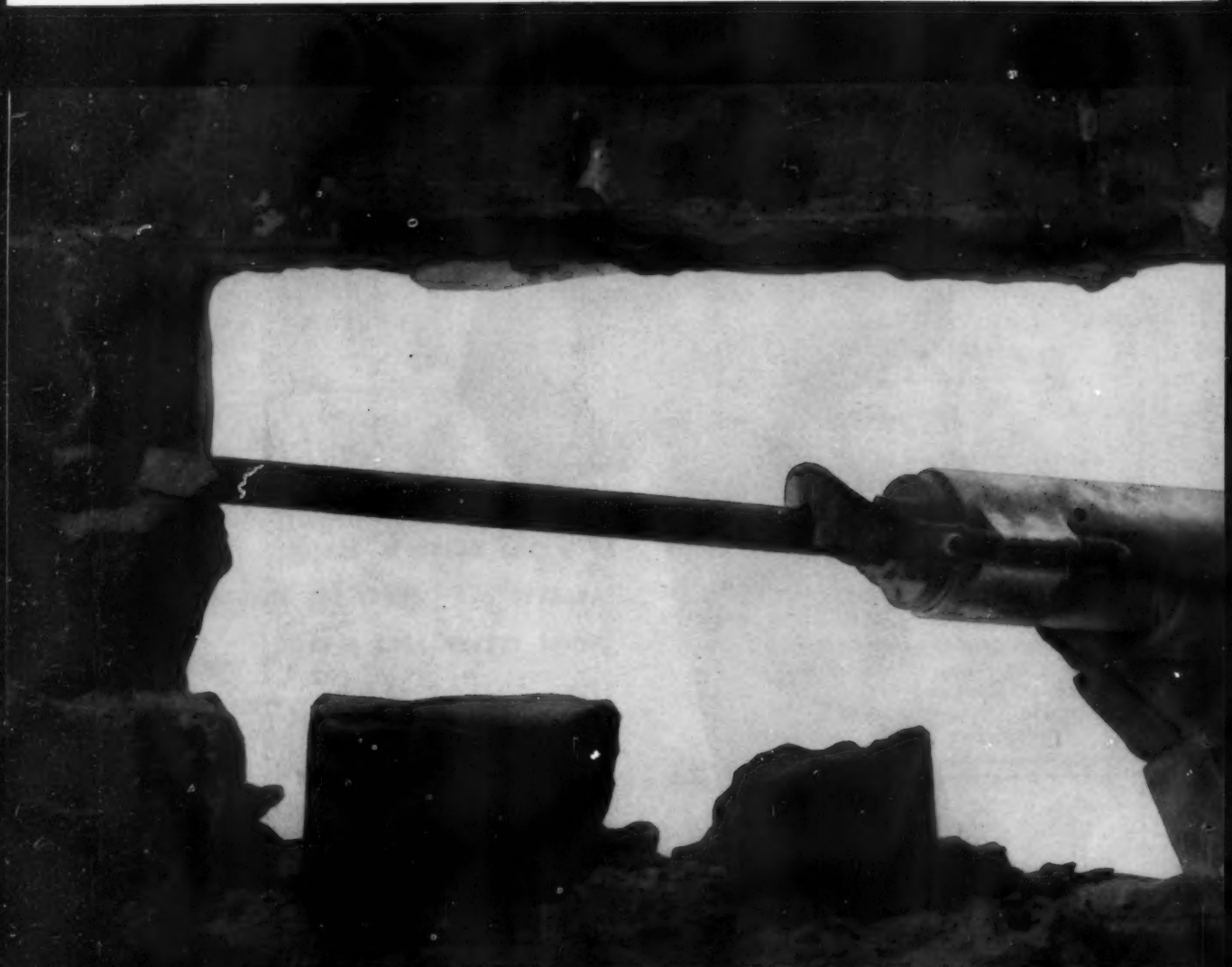
For more facts circle 528 on Reply Card



BLASTING HAMMER STANDARDS WIDE OPEN!

FREE YEAR'S SERVICE

You've heard B&D Hammers are tough! You've heard they're practically maintenance-free! Now Black & Decker *proves* its faith in these rugged tools with a certificate good for free service and parts for a year.

***You don't pay a penny for normal maintenance during a whole year of operation, under the terms of the service certificate.**

There are other reasons why you should want Black & Decker hammering away at your jobs. Initial cost, for example. Check around and you'll find that Black & Decker Hammers cost less than other makes of the same capacity. Also you'll find the maintenance costs on B&D Hammers low in relation to output.

More reasons? Look to Black & Decker versatility

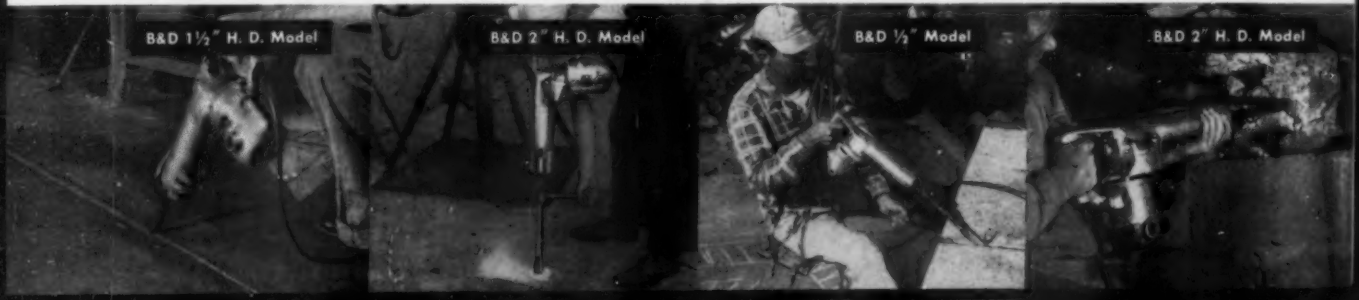
B&D HAMMERS COMBINE VERSATILITY WITH POWER TO GIVE YOU

Use B&D Hammers for channeling, chiseling, digging.

Use B&D Hammers for setting shields, drilling, piercing.

Use B&D Hammers for slotting, caulking, breaking.

Use B&D Hammers for smashing, battering, shaking.



ONLY BLACK & DECKER DARES OFFER

-ALL PARTS AND LABOR*

and power. Whichever of B&D's four hammer models and many accessories you need . . . whatever the job . . . Black & Decker's exclusive spring-and-compressed-air power transmission delivers tremendously effective IMPACT per blow for faster work, better work. Ask now about the free service certificate with B&D Hammers. Sold by leading distributors everywhere.

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Use B&D Hammers for cleaning, shaping, peening.

Use B&D accessories designed especially for B&D Hammers.

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PLANT ENGINEERS' DIGEST®—so those who rush may read and know what's new

Tips on the Proper Methods of Storing Stainless Tubing or Pipe

How STAINLESS TUBING is stored is important, especially if the period of storage is likely to be long. Here are some tips:

Use storage racks. Racks should be provided for stainless pipe and tubing, both when the material reaches the plant and when it is standing by for fabrication.

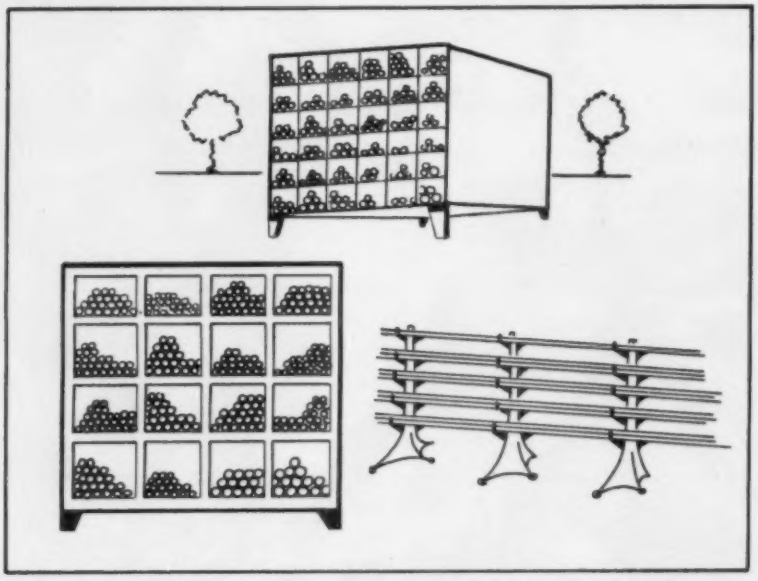
For proper storage, use either wood or thoroughly painted iron racks. If using iron racks, either paint them or cover the stainless-supporting surfaces with wood.

Avoid galvanized surfaces. Stainless tubing or pipe should never be stored on bare galvanized surfaces or in the same bins with galvanized pipe. The sliding of stainless over a zinc surface can be harmful if the stainless is later heated during use.

Galvanized iron racks should be painted or covered with wood.

Beware of moisture. Moisture by itself is not harmful to stainless. But when it contains chemical fumes, dust, etc., it can be very destructive.

The fumes or dust may not result from your own operations. A nearby plant's waste can also contaminate your stainless in storage. Wherever possible, keep your stainless both clean and dry. For outdoor storage, be sure stainless is so placed that it will drain and dry rapidly.



Suggested methods for storing stainless pipe or tubing indoors and out.

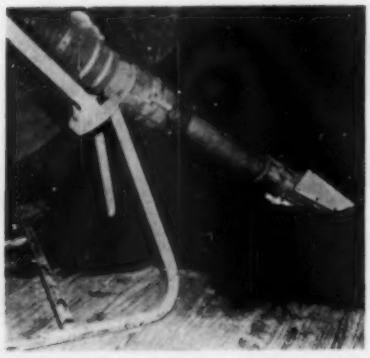
For proper drainage and quick drying of stainless in outdoor storage, racks should be kept at a slightly tilted position. Ideally, outside storage racks should contain separators or bins to provide air space between small groups of tubes.

Physical damage. You are inviting damage if you allow pipe and tubing to be exposed to areas where lift trucks or cranes are operating.

Material handling personnel should be instructed to handle stainless tubing with reasonable care—to avoid placing other material on top of tubing or otherwise exposing it unnecessarily to possible damage. If polished tubing is used by your company, the protective wrapping should not be removed until the tubing is ready for fabrication. *From a release of The Carpenter Steel Co., Alloy Tube Div., Union, N.J.*

Pneumatic System Unloads Grit

INSTALLATION of a pneumatic unloading system, including a portable collector, that is used to unload foundry sand and blast cleaning grit has saved many hours at General Dynamics' Electric Boat Div. at its Groton, Conn. plant. Sand and grit from boxcars are unloaded to one of three bins in different plant locations.



Unloading tool is used to pull grit through flexible hose, into collector.

To unload a boxcar, the collector is moved by crane, attached to a hatch above the appropriate bin then connected to the unloading tool. When the blower motor is turned on, a vacuum is created in the conveying line and unloading proceeds.

One man now unloads a boxcar of sand in eight man-hours whereas it previously took eight men from 32 to 55 man-hours to unload the same amount—a saving of 75 per cent in man-hours.

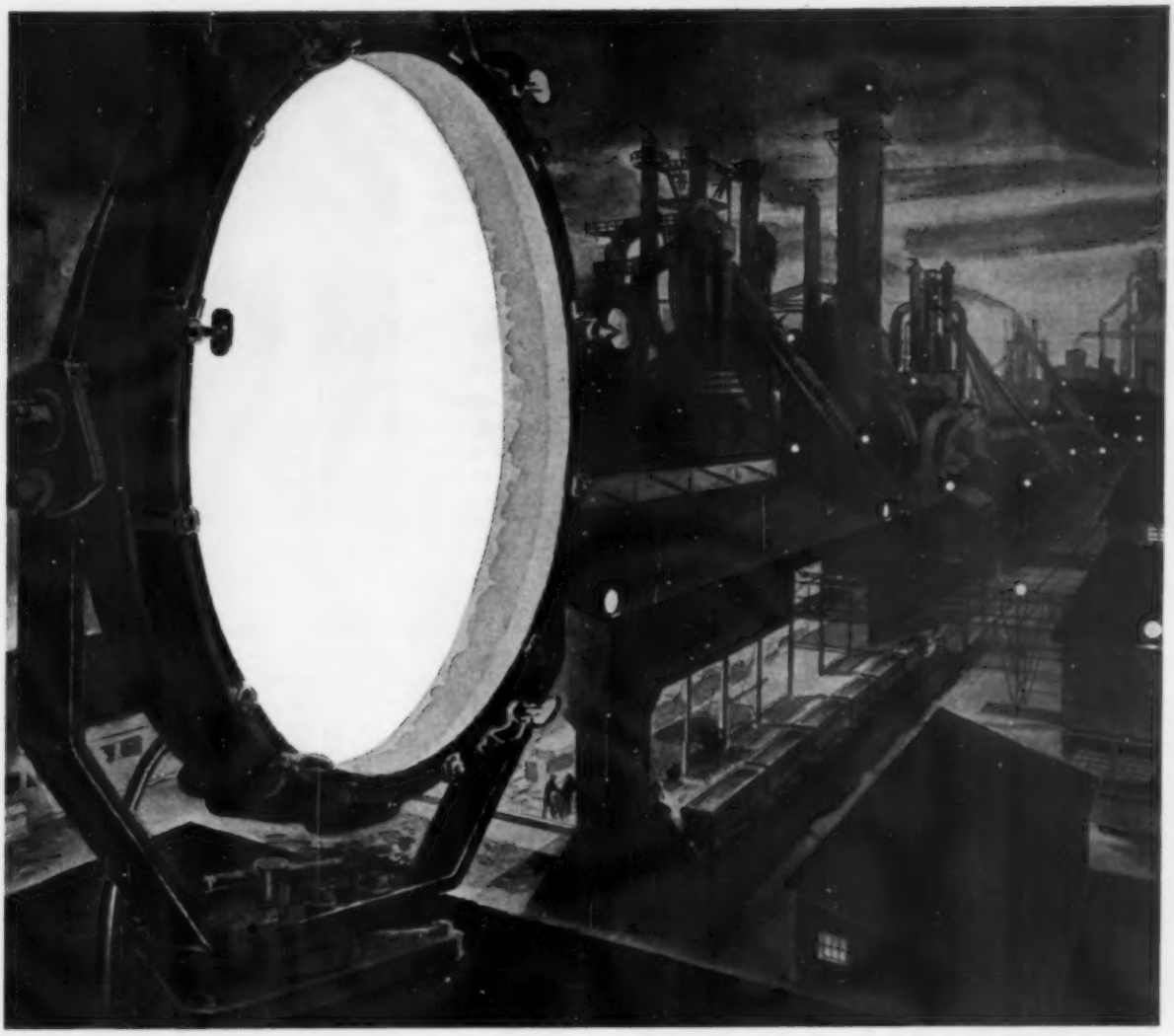
After handling 40 boxcars of sand and grit, only the conveying piping system has shown wear. *From a release of Allen-Sherman Hoff Co., Wynnewood, Penn.*

Cleaning Hot Water Systems

ALL HOT WATER HEATING systems, including snow-melting and radiant panels, converters and systems using anti-freeze solutions, should be cleaned on completion of the installation to help prevent deterioration.

If a system has been allowed to deteriorate and leaks and above-normal water losses have developed, it is possible to cause serious damage to the boiler. It is important to have a

(Continued on page 42)



What do you look for in a
HEAVY-DUTY FLOODLIGHT?

When you buy a floodlight for heavy duty service, you want one that was specifically designed and constructed for that service.

Sheet or strip metal, for instance, does not fill the bill for heavy duty applications. We use it in the floodlights we make for *general purpose* applications, and these are available in many types where lighter construction is adequate.

But if your application calls for high resistance to shock, vibration, corrosion, extreme weathering, rough handling or accidental impact, you're talking about a *heavy duty* floodlight . . . made not with sheet metal, but with first-quality solid castings of high impact strength and natural toughness.

The special aluminum alloy castings in Crouse-Hinds Heavy Duty Floodlights are free of built-in stresses, and present a rugged armor against the roughest environments. Lenses are extra tough and well cushioned against shock and vibration. These are floodlights that can take punishment in just about any form short of sabotage – and even that requires some ingenuity.

Types and sizes are numerous; 200W-2000W incandescents in 12″ to 24″ lens diameters; 250W-1000W mercury vapors in 12″ to 20″ diameters. Order from five different beam spreads to light any shape or size area.

For complete specifications, see our Catalog #320 or Bulletin #2714 . . . or ask your Crouse-Hinds Distributor.

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For more facts circle 529 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

closed system that is clean, neutral and watertight.

Cleaning a hot water system that has steel or copper piping is neither difficult nor expensive. Trisodium phosphate, sodium carbonate and sodium hydroxide are the materials most frequently used, in that order of preference. Each should be used in the following proportions, using only one type of solution in a system: trisodium phosphate, 1 lb for each 50 gal of water in the system; sodium carbonate, 1 lb for each 30 gal; and sodium hydroxide, 1 lb for each 50 gal.

Fill, vent and circulate the system with this solution, allowing it to reach design or operating temperatures if possible. After circulating a few hours, the system should be drained completely and refilled with fresh water. Usually enough of the cleaner will adhere to the piping to give an alkaline solution satisfactory for operation. A pH reading between 7 and 8 is preferred, and a small amount of cleaner can be added if necessary.

A clean, neutral hot water system should never be drained except for an emergency or necessary servicing of equipment. Anti-freeze solutions in systems should be tested from year to year as recommended by the manufacturers. Once cleaned a system will not need cleaning again. *From a paper by Donald B. Gardner, Engineering Dept., Bell & Gossett Co., Morton Grove, Ill.*

Restore Floor for Truck Traffic

To REPAIR a broken floor in an aisle at Hudson Wire Co., Ossining, N.Y., sheets of ½-in. plywood were laid over the existing floor to assure a sound base. A cap sheet was laid, on which steel grid flooring was anchored. A heavy duty mastic flooring compound was applied and power compacted by machine to speed application and produce a heavier compaction than would be possible with hand troweling. This provided a smooth tough surface for easy rolling of trucks. *From a release of The Tremco Manufacturing Co., Cleveland, Ohio.*

Conveyor Carries Nails Uphill

A NEAR-VERTICAL steel conveyor belt is being used to carry a stream of nails from a floor-mounted hopper to the overhead infeed chute of an annealing furnace at a Montreal, Quebec, steel company. Magnets, positioned behind the load-carrying strand, pull the nails from the hopper to the belt and hold them against it during their upward journey.

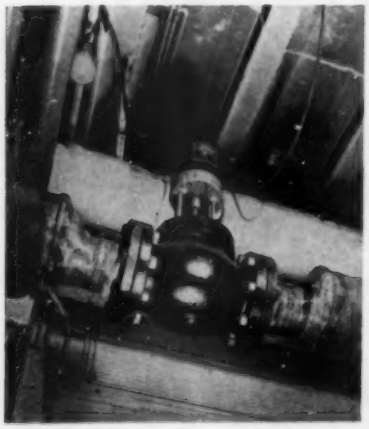
Magnets on steel conveyor carry nails from the hopper to furnace.

A steel belt was selected for this application because it is undamaged by the sharp nail points that continuously impinge against it. The steel used is specially trued and flattened for the conveyor application. It has two rubber V-ropes bonded to the under side which run in grooved terminal sheaves and provide perfect tracking for the belt. Without this arrangement, there is a tendency of the belt to run loose at the bottom terminal. Similar V-ropes were bonded near the edges of the outer surface to make sure the nails would not fall off the belt, but the magnets worked so well that these ropes proved to be unnecessary.

The magnets are of the horseshoe type and are mounted on rails that extend from opposite the feed hopper to the top of the conveyor. The nails discharge over the top of the conveyor and fall into the chute to the annealing furnace. *From a release of Sandvik Steel Belt Conveyors, Division of Sandvik Steel, Inc., Fair Lawn, N.J.*

Reducer Adapts Old Pipe to New for Valve Installation

How TO install a four-inch motorized valve in existing seven-inch carbon steel piping was the problem that faced the Federal Land Bank, Louisville, Ky., in revamping their heating system.



Cutting down standard eight-inch by four-inch eccentric reducers at their proper point saved half a day over other methods of fitting valve to pipe.

Because seven-inch pipe is an obsolete size, not matched by any present day reducer, the large ends of two eight-inch by four-inch eccentric reducers were flame-cut and beveled at the proper point on their eccentric conical sections. The cut-down reducers were then welded to the old-size pipe, welding neck flanges were added and the flanged valve mounted.

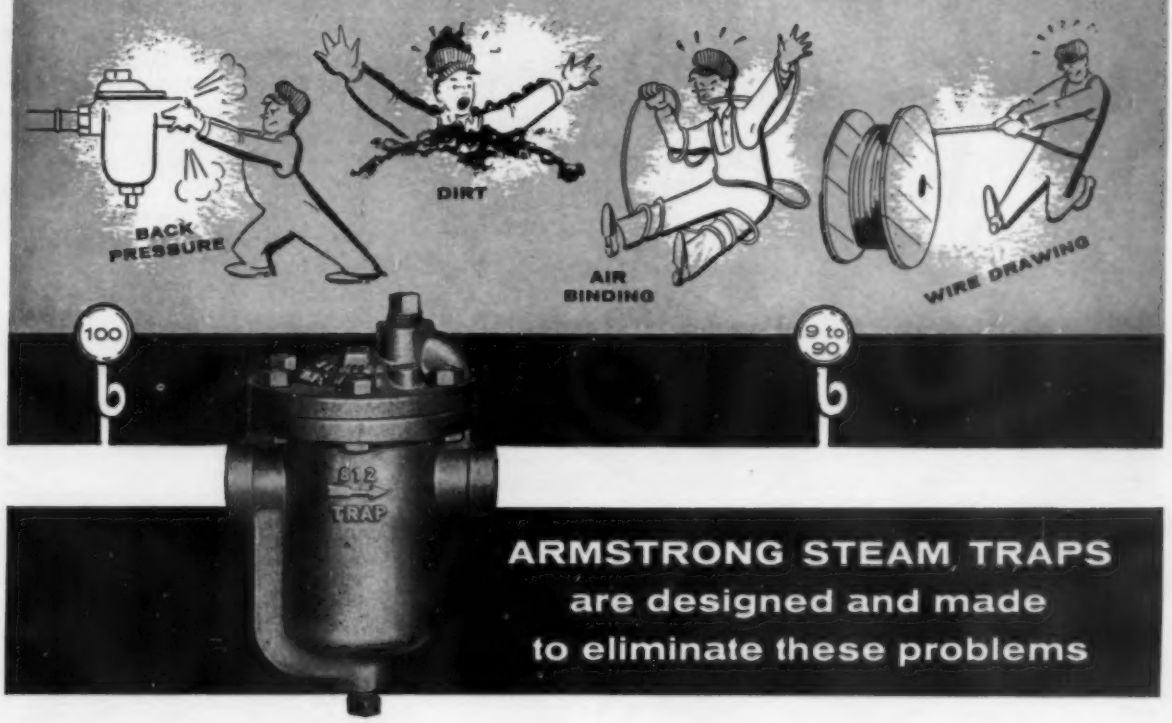
Uniform wall thickness and true circularity made it possible to cut the eccentric reducers at the desired point and achieve a perfect match with the obsolete size pipe. Installation took a weldor and fitter less than half a day. An alternate method, "orange peeling" the old pipe down to four inches would have taken a full day. *From a release of Tube Turns Div. Chemetron Corp., Louisville, Ky.*

Handling Corrosive Fumes

CUSTOMARY SMELTING methods cannot be used with zirconium, so specially developed methods of chemical separation and reduction are required. As a result of this special process, vapors are produced which

(Continued on page 44)

Have you ever been troubled by any of these steam trap problems?



ARMSTRONG STEAM TRAPS are designed and made to eliminate these problems

BACK PRESSURE . . . Armstrong Traps operate on any back pressure—or vacuum, for that matter. As long as there is a pressure differential across the trap, it will close on steam and open for condensate. Even the high back pressure caused by blow through of one or more traps in the system will not disturb Armstrong Traps. Other than a reduction in capacity, Armstrong Traps are unaffected by back pressure.

DIRT . . . Armstrong Traps are not affected by ordinary dirt. When the trap opens condensate swirls down under the edge of the bucket and up through the discharge orifice. Dirt is kept in suspension and discharged along with the condensate. For very bad dirt conditions, Armstrong offers traps with integral strainers. These cost less than a trap plus a separate strainer.

AIR BINDING . . . Armstrong Traps cannot air bind. Air in the system passes through a vent in the top of the bucket. It collects in the top of the trap and is discharged with the condensate. There is no chance for it to stop the trap. For low pressure on-and-off units where large amounts of air accumulate while the steam is off, Armstrong offers open float and thermostatic air vent traps in a complete range of sizes.

WIRE DRAWING . . . Armstrong Traps are designed and made to resist wire drawing. The valve and seat are tough stainless steel. The valve opens and closes tightly with a fast action and is always water sealed. There is virtually no chance for grit or sediment to lodge in the valve, virtually no chance to create conditions that lead to wire drawing.

There's no need to accept any of these problems as "inevitable." Your local Armstrong Representative can show you how to end them all. Call him today or write direct.

860 Series for low pressure heating service.

800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

Forged Steel Series for high pressures, high temperatures.

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

ARMSTRONG MACHINE WORKS

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See Our Catalog in Sweet's Plant Engineering File

For more facts circle 530 on Reply Card

RESISTS CORROSION

This new super line of "Chem Marine" devices are engineered from corrosion resistant materials capable of withstanding the harmful effects of moisture, brine, grease, oils and many acids. They are designed for industrial applications such as plating rooms, shipping platforms, yards, shops, warehouses, or wherever corrosion or chemical action is a problem.

Special Materials:

"INSULPRENE"—a Du Pont neoprene compound.

"MONEL® METAL"—Reg. Trademark of INCO.

"MELAMINE"

"CYMEL®"—Reg. Trademark of Am. Cyanamid

HEAVY NICKEL-PLATED CURRENT CARRYING PARTS.

52CM62
3-wire, 15 amp., 125 volt "Melamine" Duplex Grounding Receptacle
74CM20
Metal Weatherproof Lift Cover Plate with heavy vinyl coating for single receptacle. Shown with 73CM10 "Twist-Lock" Receptacle and mounted in standard FS box.
99CM60
Shown with "Insulprene" "Seal-Tite" Cover 75CM31
52CM11
Weatherproof Lift Cover Plate for duplex receptacles used with FS boxes.
17CM51
Weatherproof "Insulprene" Plate and A.C. "Presswitch" Combination.
Listed by: Underwriters' Laboratories, Inc.
99CM66
3-wire, 20 amp. "Insulprene" "Twist-Lock" Connector Body

"Chem Marine" devices are identified by their bright yellow color and a few representative items are illustrated above. For complete information contact the "Chem Marine" Department, —

HARVEY HUBBELL, INCORPORATED

BRIDGEPORT 2, CONNECTICUT, In Canada: Scarborough, Ontario

For more facts circle 531 on Reply Card

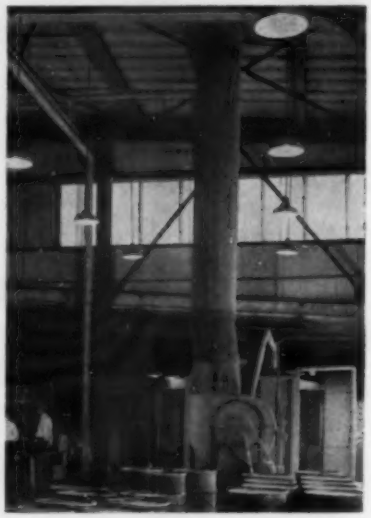
PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

contain considerable wet chlorine and other corrosive gases, which must be exhausted. This is necessary for the process and for the safety and comfort of personnel.

Portions of the process at Carborundum Metals, Niagara Falls, N. Y., occur in a system that cannot be entirely enclosed, thus allowing corrosive materials to escape into the building itself. Ventilation is re-required in the plant's process equipment area.

In 1954, several test pieces of resin-bonded, glass reinforced equipment were installed in chlorine-contaminated areas. Subsequently, similar equipment was installed in other areas of extreme corrosion. Because of its light weight, installation of the ductwork and exhaust stacks required no extensive rigging or blocking.



Glass fiber reinforced duct moves chlorine fumes from drying process.

After six years' use in a corrosive environment, the equipment is still in good condition. *From a release of Du Verre Inc., Arcade, N. Y.*

Heat Treating Oven Hung from Roof Trusses

BY HANGING an oven for aging aluminum castings from the trusses, a foundry conserved about 4500 sq ft of floor space. It also reduced truck-

A cylinder doesn't think but you do—and when you turn your thoughts to how a machine can perform, a lot of things can happen.

The cylinder responds instantly when activated, and does exactly what you tell it to do with pre-set adjustments. You can synchronize it with the motion of related machines or attach it to a moving machine.

It will produce almost any kind of motion—and do so *without the use of complex mechanical contrivances!*

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___100-4 AIR VALVES	___200-4 and 200-7 HYD. VALVES
___100-5 LOGANSQUARE CYLS.	___200-6 SUPER-MATIC CYLS.
___100-6 ULTRAMATION CYLS.	___ABC BOOKLET
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H. K. PORTER COMPANY INC.

Porter serves industry with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

For more facts circle 533 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

ing and conveying requirements by employing the oven's built-in materials handling facilities to deliver castings to the plant loading dock while the heat treating was in progress.

The oven, installed at Aluminum Foundry Division of Chevrolet Motors, is used to stress-relieve aluminum cylinder heads, transmission cases and engine blocks. It is 150 ft long, 30 ft wide, and hangs 8 ft below the trusses. A two-zone unit, it brings the castings up to a temperature of 400 F in the first section and maintains the castings at that temperature for 3½ hr in the second section.

Castings are picked up at the cleaning department by an inclined conveyor, are routed through the oven and delivered at the oven exit four hours later.

To make this installation possible, oven weight, roof-truss strength of plant, work processing area inside the unit and amount of headroom for ground traffic, were all taken into consideration.

Through use of a special bridge system, only one roof truss had to be reinforced. Better weight distribution was achieved by deviating from conventional oven construction. Longer and stronger oven floor panels made it possible to eliminate underside steel bracing, leaving more headroom underneath, and giving six inches more working space inside the oven. Side runners employed in the suspension of the oven were made of formed members, rather than conventional steel.

A walkway around the oven is provided for maintenance service. *From a release of the R. C. Mahon Co., Industrial Equipment Div., Detroit, Mich.*

Radio Spares Men, Speeds Orders

INSTALLATION of a walkie-talkie system of radio communication in our shipping rooms has provided an economical, safe and speedy means of getting customers' orders filled promptly.

With the growth in the number of items manufactured, rapid processing of customer orders often bogged down

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THIS
HIGH-VOLTAGE
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FUSE...

Damaging currents are choked out in ½ cycle

Inside General Electric high-voltage current-limiting fuses, damaging short circuits are limited to harmless levels and choked out in ½ cycle or less to prevent damage to protected equipment.

When short circuits reach a value and duration great enough to melt the fuse element, resistance increases immediately on the rising portion of the current wave. Complete interruption occurs at the first voltage zero after melting—or within approximately one-half cycle—without discharge or noise.

General Electric high-voltage current-limiting fuses are sure to meet your application requirements—indoors or outdoors—for protection of capacitors, motors, transformers, load centers, feeder circuits, and for general purpose duty. They're available in all standard voltage ratings from 600 to 34,500; and in a range of amperage ratings designed to meet any need.

Want more information? Contact your General Electric apparatus sales representative. Or write to Section 497-01, General Electric Co., Schenectady 5, New York.

GENERAL ELECTRIC

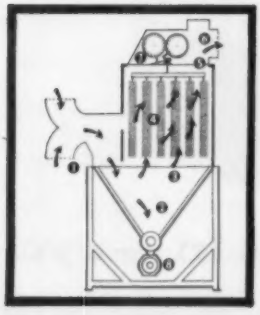
For more facts circle 534 on Reply Card

NEW TORIT DUST COLLECTOR IS AUTOMATIC!

Save real dollars with the benefits from this *automatic* dust collector. No more interruptions on production lines! Maintenance problems are practically eliminated. This all new continuously cycling TORIT dust collector *automatically* cleans your air and *automatically* shakes its own filters and blows them clean with reverse air flow. Collected material is emptied *automatically*.

OTHER EXCLUSIVE TORIT BENEFITS

- automatic filter-shaker mechanism is simple, maintenance-free
- different dusts may be collected separately
- highest air-to-cloth ratios (from 5 to 25:1) and longer filter life
- only ¾ H.P. required for fully automatic operation
- polished 3/16" aluminum construction for minimum floor loading
- modular design—5' wide x 4'-8" long (for two sections) x 15'-6" high—saves space, lends ease and versatility to installation. Use up to 12 modular sections for each application! No limit to CFM capacity!



AUTOMATIC AND EFFICIENT, the filtering cycle of each TORIT section is self-timing. A separate blower on the clean air side keeps collector under suction. Then, (1) dust-laden air is taken into manifold; (2) coarse dust drops out; (3) fine dust is carried to filtering sections; (4) filter tubes catch dust on inside surfaces; (5) clean air emerges from filters; (6) to suction fan and clean air discharge outlet. (7) *Automatic* shaking and reverse air filter cleaning mechanism. (8) Conveyor *automatically* removes and discharges accumulated dust.

Have a cleaner plant, better morale and high productivity with lowest maintenance costs. Special design services are available based on your individual requirements. Write today for literature.

TORIT MANUFACTURING COMPANY
Automatic Collector Division 1133 Rankin St., St. Paul 16, Minn., Dept. 1834
For more facts circle 535 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

Floor operator locates item on master chart in his hand, then radios the information to his partner in crane.

in the 1000-ft-long plant warehouses.

Formerly, as requisitions for shipment were received by the floor foreman, they were relayed to an overhead crane operator simply by shouting above the din caused by a nearby manufacturing operation.

To change this situation, a two-man team was organized, with one man operating the three-ton overhead traveling crane and the other stationed on the ground with a Motorola microtalkie transmitter, operating on a citizen's band.

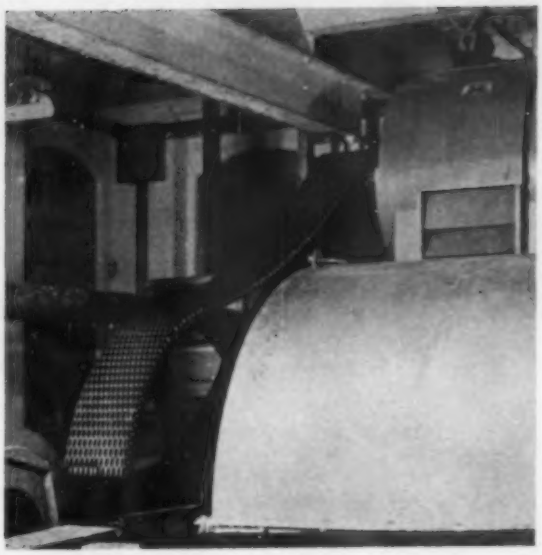
When the shipping order is now received by the man on the ground, he refers to a current master chart of the inventory, and locates the position of the required item in the stacks. He then radios this information to his partner who has a duplicate blueprint and inventory of the stacks.

Plant engineers reported that installation of the radio system has cut order-filling time by at least 10 per cent and has saved much leg-and lung-power of the two-man team. *From a release of Dresser Manufacturing Div., Dresser Industries, Inc., Bradford, Pa.*

Fireproofing Reduces Insurance

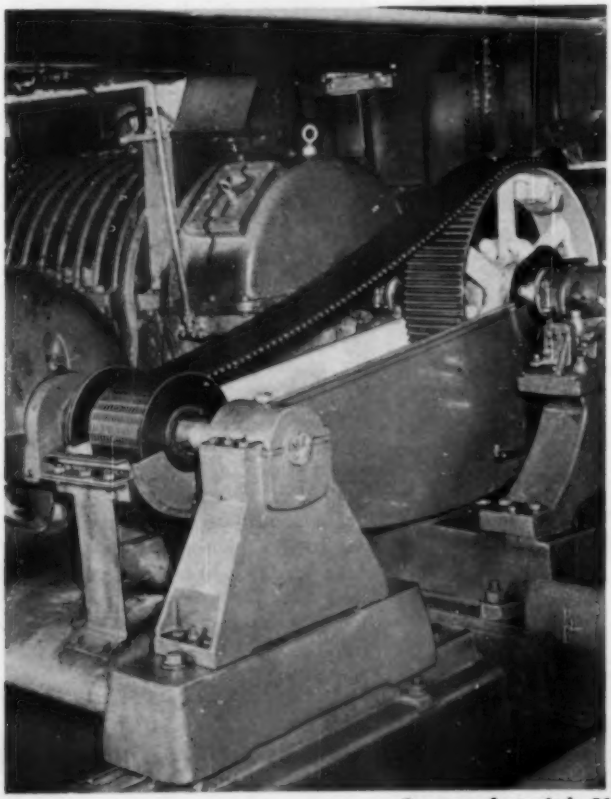
FIRE INSURANCE premiums were cut $9000 per year at Dannen Mills, Inc., processing plant at St. Joseph, Missouri.

By covering the steel supports of



WHERE MINIMUM MAINTENANCE AND MAXIMUM DEPENDABILITY are required of a drive, Link-Belt silent chain drives are unexcelled for light or heavy load applications. Slipless transmission of power to this pulp beater results in a high quality pulp of uniform consistency and in less time than with other types of drives.

Link-Belt silent chain for drives that can't afford to slip



Smooth, positive engagement assures full power transmission

Continuous, nonslip operation for many years with only routine attention—this is a common experience with Link-Belt silent chain. Where other types of drives are impractical due to slipping tendencies, this modern chain drive delivers positive transmission of full-rated horsepower.

Link-Belt silent chain assures efficiency for either large or fractional-horsepower drives. Easy assembly in tight spaces permits built-in drives, compact housings. Close grouping of equipment saves valuable floor space. High humidity, temperature have no effect on performance. Ratios as high as 10-to-1 are accommodated on relatively short centers.

Available in a full range of sizes. For complete information, call your nearby Link-Belt office or authorized stock-carrying distributor. Ask for Book 2425.

WHERE SPACE IS LIMITED, compact Link-Belt silent chain drives permit close grouping of equipment. High ratio reductions are easily accommodated on relatively short centers.

LINK-BELT

19,807

SILVERSTREAK SILENT CHAIN DRIVES

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World.

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MODERNIZE–
ECONOMIZE–
STANDARDIZE–

...WITH these electrical systems by

STANDARD

TIME CONTROL SYSTEMS

PUBLICATION NO. 250

Centrally controlled, synchronized clocks, time clocks and job time recorders reduce production costs by registering time on a consistent basis throughout entire plant. Yard lights, utilities, signals programmed for automatic operation reduce personal attention required . . . eliminate human error.

FIRE ALARM SYSTEMS

PUBLICATION NO. 251

With automatic "locator" feature that permits instant identification of trouble area . . . confines fire or sprinkler damage by making possible immediate action.

ELECTRICAL TEST EQUIPMENT

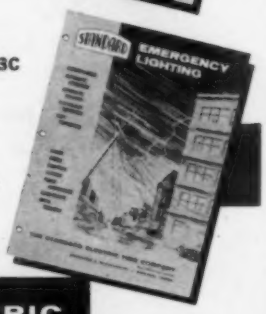
PUBLICATION NO. 247

Voltage distribution panels, test stands, control consoles—custom designed by specialists—for lab or production line test use.

EMERGENCY LIGHTING

PUBLICATION NO. 243C

For protection of personnel, plant and property. Instantaneous, automatic operation—electrically supervised, 100% dependable, with automatic recovery.



THE STANDARD ELECTRIC TIME COMPANY

89 LOGAN STREET, SPRINGFIELD, MASSACHUSETTS

For more facts circle 537 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

its soy bean processing plant with sprayed asbestos, the insurance savings more than paid for the fireproofing project.

The basic objective of fireproofing the plant was the protection of the processing equipment and the building. A fire in the plant might cause the steel building to collapse.

Several conventional fireproofing materials had to be ruled out because of difficulties in applying them to the high structure; the building frame was not designed to carry the weight. Extensive improvements to the existing water supply ruled out the installation of a sprinkler system.

Effective and uncomplicated fire-

Sprayed asbestos covering will keep temperature of I-beams at safe level.

proofing was obtained by applying this asbestos fiber product, sprayed dry, with an inorganic binder, from the nozzle of a special "gun". The fibers mix with water, also sprayed from the gun, and the resultant slurry clings to the surface to be protected, providing light-weight, permanent heat and acoustical insulation.

For protection against collapse of the roof, a blanket of the covering was spray-shaped to the steel I-beam columns which support the roof. The 1½-in. covering prevents a temperature rise of 250 F for a period of two hours, and will continue to pay dividends in the form of lower insurance premiums. *From a release of Keasbey and Mattison Co., Kansas City, Mo.*

PPG Fiber Glass Pipe Insulation is quickly installed, provides top thermal insulation at Fontainbleau Towers addition in Miami Beach. 100,000 ft of this insulation was used, as well as PPG Duct Liner and Duct Insulation.

"We chose PPG Fiber Glass Insulation Materials because they are easier to handle than any other insulation products"

. . . says Mr. Joseph Crabtree, President, Crabtree Insulation Company, Miami, Florida

Crabtree Insulation Company had the contract to install all pipe and ductwork insulation in the new 405-room addition to Fontainbleau Towers, Miami Beach. Choice of materials was given to the company.

Mr. Crabtree asked his superintendent what materials he felt should be used, and was advised that the men preferred PPG Fiber Glass Insulation Products because they were easier to handle.

As a result, Crabtree Insulation Company used 100,000 ft of PPG Pipe Insulation, 25,000 ft of PPG Neoprene-coated Duct Liner, and 25,000 ft of PPG Duct Insulation in the new Fontainbleau Towers addition.

Mr. Crabtree reports the insulation job went faster and with fewer problems than if other materials had been used. On the basis of this job and other jobs where he had used PPG materials, he would recommend PPG with no hesitation to other contractors.

WANT TOP RESULTS? TRY PPG!

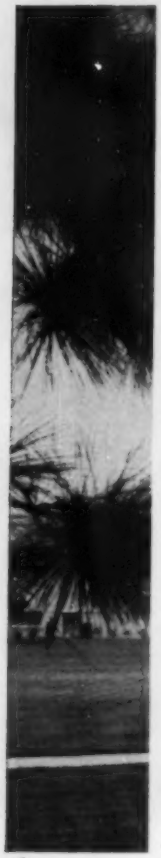
PPG has a wide range of fiber glass thermal and acoustical insulation products that speed installation, provide excellent insulating properties, give long service life with little or no maintenance. If you haven't tried them, get full information by contacting your nearest PPG Fiber Glass Sales Office, or by writing *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

FIBER PG GLASS PITTSBURGH PLATE GLASS COMPANY

Sales Offices: Atlanta, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Houston, Kansas City, Louisville, Los Angeles, Miami, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis and Seattle.

For more facts circle 538 on Reply Card

ELECTRONICS MANUFACTURER KNOWS PRECISION... CHOOSES WESTINGHOUSE EQUIPMENT TO PROTECT PRODUCT QUALITY



1.

Electronic Communications, Inc., designers and suppliers of precision electronic equipment, recently added 165,000 square feet of production area. To meet military specifications, the company has the most comprehensive environmental test facility in the southeastern U. S. Regular tests include shock, vibration, explosion, fungus, salt-sea atmosphere, sand and dust, temperature and altitude. Because of this, high electrical reliability is required.

To meet this demand, Bail, Horton (architects and engineers) specified a double-ended power center to feed power throughout the plant addition. The Westinghouse equipment provided was balcony mounted, saving valuable floor space. Double-ended design with tie breaker permits entire switchboard to be fed from either transformer at reduced voltage to maintain lighting, air conditioning and environmental tests during emergency.

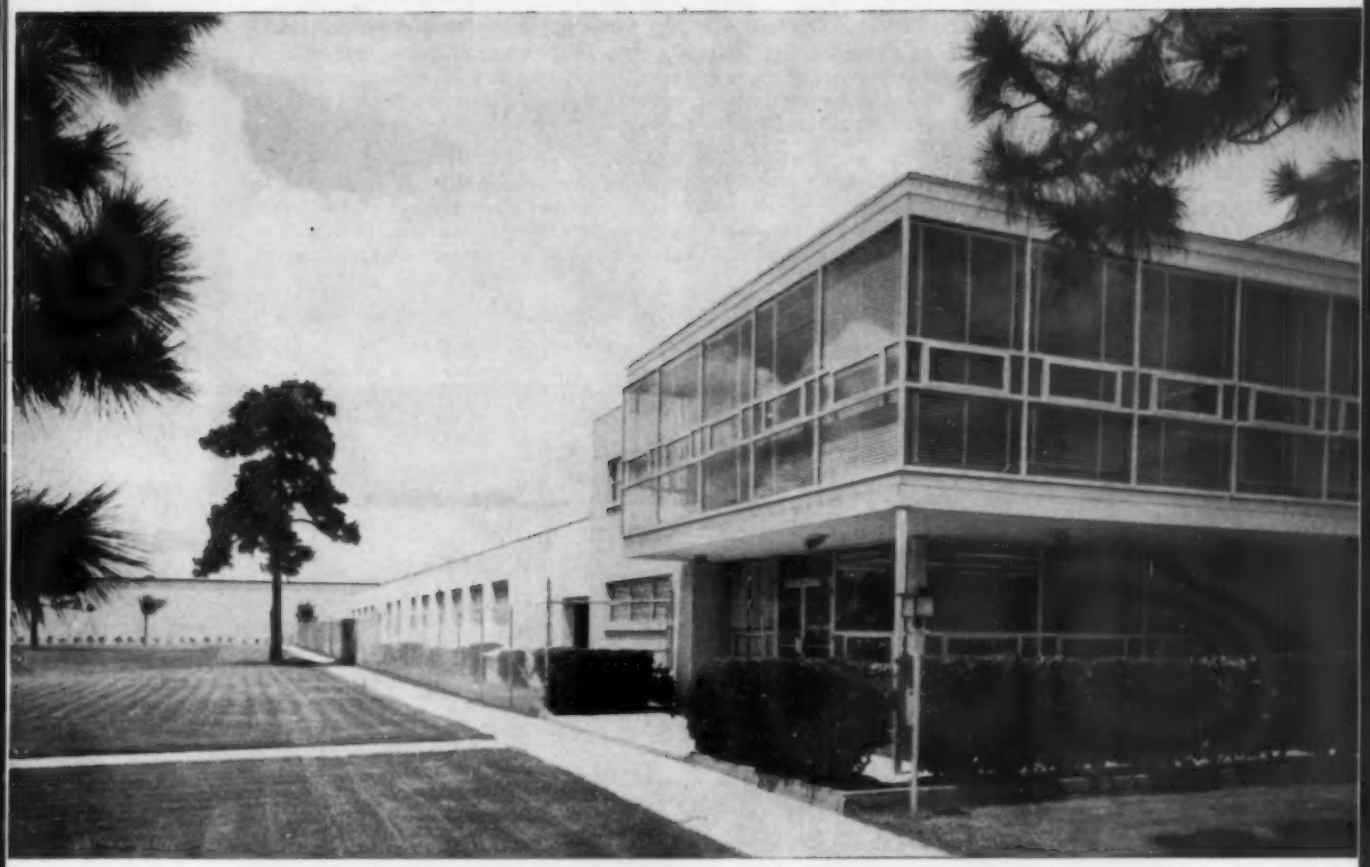
Management at Electronic Communications has declared that "specifications were written around Westinghouse equipment because the high quality of Westinghouse products was desired . . . quality second to none. Experience of our plant engineering personnel with Westinghouse products has demonstrated the reliable performance and low maintenance expense we can expect in the future."

On these and the following two pages, read how Westinghouse helps another company enter the competitive '60s Powered-Up for quality. *You can be sure . . . if it's Westinghouse.*

J-94159-1

2.

Westinghouse



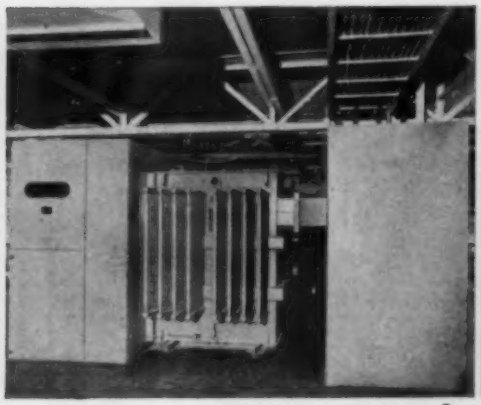
1. Attractive, modern buildings house Electronic Communications, Inc., of St. Petersburg, Florida.

2. DB-50 air circuit breakers are used as main and tie breakers in low-voltage distribution switchboard. Molded case type AB breakers serve as feeders. Breakers can readily be added to switchboard, minimizing changeover expense. Examining equipment are M. A. Lochridge, Westinghouse; John Feltman, Manufacturing Manager at Electronic Communications; and J. E. Gabrio, Gabrio Electric.

3. Heart of the plant distribution system is a 1500-kva double-ended power center. A fused 15-kv type LCB switch protects primary circuit. Shown is one of two 750-kva Inerteen®-filled transformers, which steps down voltage to 480 volts for throat-connected switchboard at right. Entire power center is balcony mounted, freeing area below.

4. Check and double-check . . . Electronic's finished products receive many inspections at test boards like these.

5. John Gabrio; J. R. Miller, Westinghouse Construction Engineer; and George Low, Plant Maintenance Supt., observe compact, lightweight Westinghouse DT-3 dry-type transformer conveniently mounted overhead. This 75-kva unit, one of many in the plant, steps voltage down economically at point of utilization. Distribution panelboard at the right, equipped with AB breakers for short circuit and overload protection, distributes voltage to lighting panels and air conditioners. At center are 100- and 200-amp AB-I breakers, and to the left of these, air conditioning safety switches.



3. 4. 5.

J-94159-2

6. Eight runs of 225-amp, aluminum plug-in bus duct carry full power throughout the plant. Plug-in circuit breakers, as shown top left, provide a convenient means of power take-off . . . can be moved or added to accommodate load changes. Breakers protect both circuits and power equipment. Bill Barlow, Wesco Salesman, at right, explains the safety door interlock feature of the plug-in breaker unit to John Gabrio and George Low.

7. George H. Bail, Bail, Horton and Associates; L. J. Hennessy of A. P. Hennessy & Sons; and John Feltman review air conditioning plans. Flexibility of the equipment made it possible to side-mount fan sections and discharge horizontally to six separate zones throughout the plant. "Free return" reduced cost of duct by several thousand dollars. System, made up of six 50-ton Westinghouse units, is as economical as possible. Maintenance can be planned ahead, one unit at a time.

8. Specialized test area, free of RF interference, behind protective copper screening; beyond, a general assembly area.

9. George Low, with M. A. Lochridge, operates a 3-pole, F frame breaker in a Westinghouse convertible distribution panelboard. AB De-ion® breakers feed and protect lighting transformers and power circuits. For change-over or expansion, breakers may be interchanged or added in the panel.

10. Reviewing electrical system are: F. Godsey, President of E.C.I.; George H. Bail, Bail, Horton and Associates; L. J. Hennessy of A. P. Hennessy & Sons, General Contractors; M. A. Lochridge, Westinghouse Sales Engineer; John E. Gabrio, Gabrio Electric Co.; Ralph E. Bail of Bail, Horton; L. W. Willey, V.P. Operations, E.C.I.

Owner: Electronic Communications, Inc., St. Petersburg, Fla.
Architects and Engineers: Bail, Horton and Associates, Ft. Myers, Fla.
General Contractor: A. P. Hennessy & Sons, Inc., St. Petersburg, Fla.
Electrical Contractor: Gabrio Electric Co., St. Petersburg, Fla.
Westinghouse Distributor: Wesco, Tampa, Fla.

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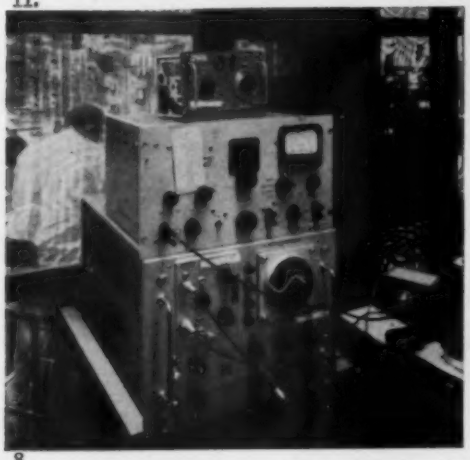

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Westinghouse

For more facts circle 539 on Reply Card

OPERATION AND PRODUCTION—pointers for the industrial plant engineer

Edited by Vern Kempf

Pivoting Hooks Carry Loads Without Need for Pallets—Increase Maximum Height of Crates Carried

AN EFFICIENT procedure for handling long, heavy crates has been developed by Aacon Contracting Company, Inc., an export packing firm in New York City, and the Ross-Carrier Division of Clark Equipment Co.

In this procedure a straddle carrier moves over a crate which has been lifted by an air-operated platform and picks it up by means of four forks, two on each side, which swing in and meet in the center to form two arms under the load. This pivot hook arrangement permits carrying loads without the use of pallets which would normally be required, thereby increasing the maximum height of a crate that can be carried.

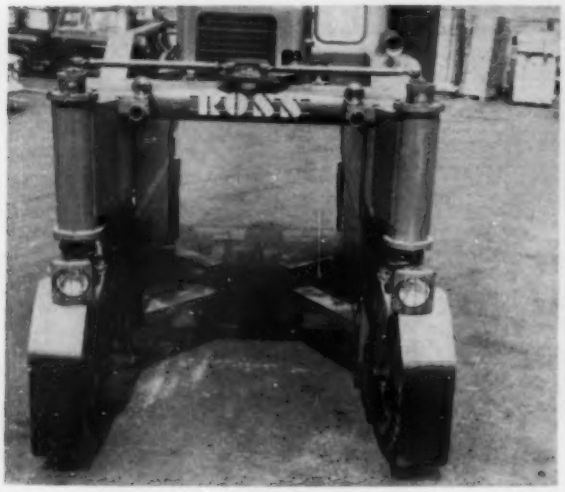
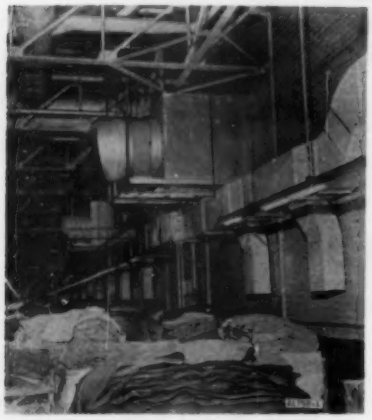


Fig. 1. Four hooks pivot under load to support it without need for pallets usually required on straddle trucks.

Fig. 2. Elimination of pallets increases maximum height of the crates that can be carried, improving efficiency.

Air Makeup Stops Drafts

AIR EXHAUSTED to atmosphere by bleachery processing equipment is replaced by four "packaged" air makeup units recently installed at the Graniteville Company, Graniteville, S. C. The air makeup units are of a relatively new standardized design and were supplied by the J. O. Ross Engineering Division of the Midland-Ross Corporation, New York.



Four 60,000 cfm air makeup units equalize air pressure to stop drafts.

Some 1,000,000 cfm of processing air is continually exhausted to atmosphere by dry cans, mercerizing ranges, wash ranges, resin curing ranges, other bleachery equipment and 35 to 40 exhaust hoods. Of the 1,000,000 cfm exhausted, only about 60 per cent is replaced by heating and ventilating systems. Without additional air supply, this loss of air would produce a negative pressure and cause drafts at doorways and windows, as air tried to rush in to replace that which was exhausted. Under these conditions, exhaust fans also have to work harder.

The four new "packaged" air makeup units supply 60,000 cfm of heated air each and bring the total replacement air up to 80 per cent of that exhausted. This is more than adequate, based on engineering standards and allows the installation of additional processing equipment without requiring more makeup air capacity.

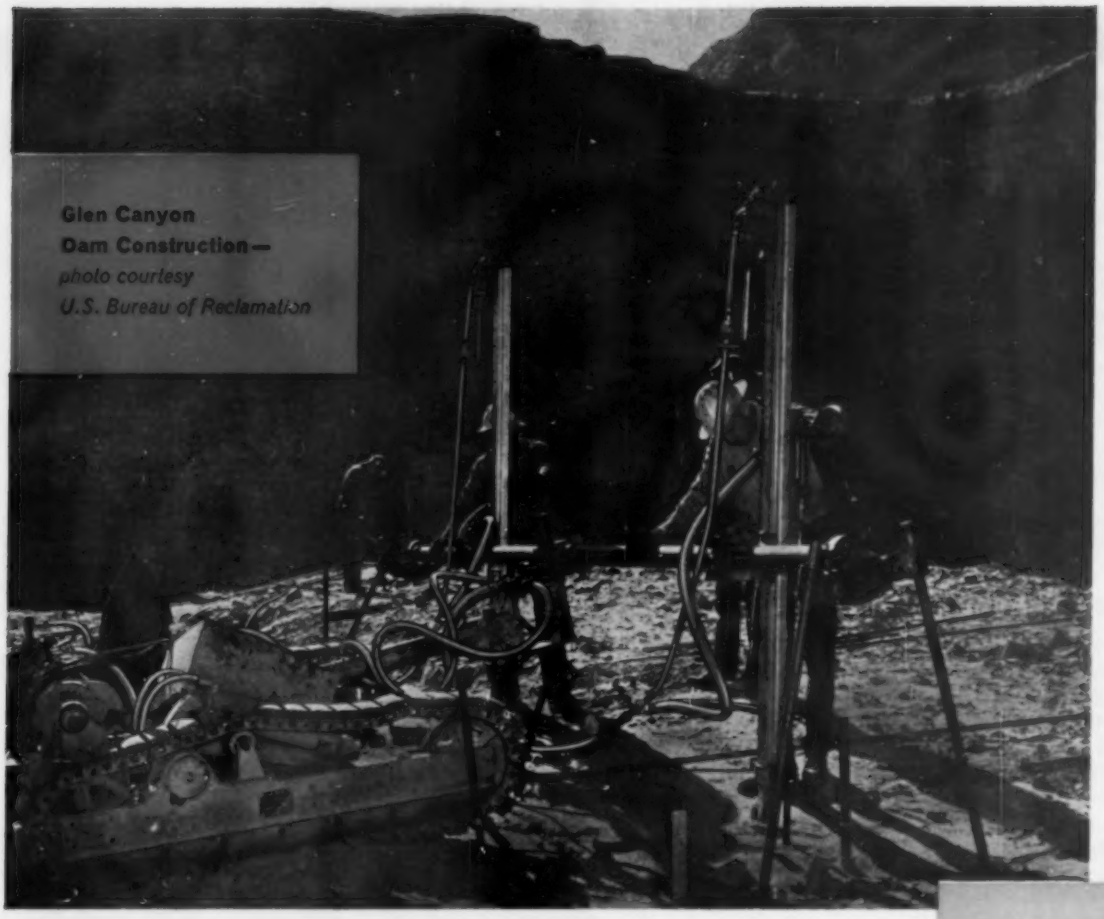
Detector Spots Flaws in Paper

AN ELECTRONIC DETECTOR with the ability to spot flaws smaller than a matchhead in paper stock moving at 1000 fpm has been developed by the Radio Corporation of America. Designed to provide the paper industry with effective quality control at lower cost, the inspection system can detect dark spots or holes one-sixteenth of an inch in diameter at high speeds.

The system also detects smudges, creases or wrinkles which may impair subsequent printing, as well as defects in the paper stock's gloss. The unit can be used in both roll and sheet production to classify paper into various quality grades.

Inspection of the paper is accom-

(Continued on page 58)



Glen Canyon Dam Construction— *photo courtesy U.S. Bureau of Reclamation*

Gates Hose moves mountains... keeps production going in industrial plants

Wherever hose is used, on construction projects or in industrial plants, you find Gates Hose giving outstanding service. Gates makes a hose for every industrial application—air hose, water hose, steam hose, suction hose—every type of industrial hose in a full range of sizes. All are dependable, top-quality products of Gates continuing program of *Specialized* Research.

You get fast delivery from local stocks. The hundreds of Gates Distributors, located in all parts of the country and throughout the world, have large stocks of hose on hand, backed by Gates servicing warehouses in every major industrial center.

This means that you always get quick delivery of Gates Industrial Hose from a local source.

Call your nearby Gates Distributor when you need hose of any kind, for any purpose.

The Gates Rubber Company, Denver, Colorado BP-51A

GATES 19HB PREMIUM QUALITY AIR DRILL HOSE

is used on most major construction projects. Highly resistant to abrasion, it is also flexible and easy to handle. It gives exceptional performance and long service on all light and heavy duty air drill applications under the most severe conditions.

A Gates Hose for any industrial need is quickly available from your nearby Gates Distributor:

Building the future on 30 years of progress

Gates

Gates Industrial Hose

For more facts circle 540 on Reply Card

OPERATION — PRODUCTION

(O and P begins on page 56)

plished by monitoring the light reflected from its surface. The inspection head contains a specially designed illumination and viewing unit which, in combination with a series of photo-electric elements, converts the visual quality of the paper surface into electrical information.

A control rack, separate from the detector unit, contains the signal and classifying circuitry. For increased reliability and ease of replacement, transistorized plug-in modules are used in the unit.

Bell Joint Eliminates Fittings

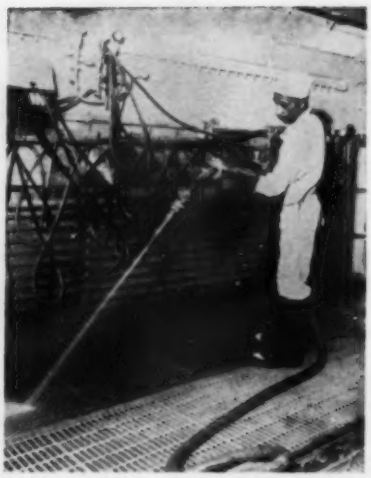
A NEW METHOD of joining vinyl pipe uses a conventional bell and spigot slip joint coupled with a rubber O-ring. One end of each pipe length is heated and belled out on a mandrel so that the inside diameter exceeds the outside diameter of the plain pipe end. An O-ring, made of Hycar nitrile rubber is slipped over the plain end which is then pushed into the bell end of the next section of the pipe. Hycar is a product of B. F. Goodrich Chemical Company.

To complete the joint, a portable oven, using infrared lamps or bottled gas is placed around the bell which is then heated for four to eight minutes. When the heat is applied, the "elastic memory" of the bell sets to work and it tends to return to its original shape and dimensions, thus squeezing tightly around the plain pipe end and the O-ring. The resulting joint can move sufficiently to take up any expansion and contraction caused by temperature changes. This eliminates the need for conventional expansion joints.

Construction costs are reduced because the joint eliminates the need for wide trenches since snaking of the pipe to allow for thermal expansion and contraction is no longer necessary. Contractors have found that an eight-inch pipe, joined by this method, can be laid straight in a 10 in. wide trench and a 10 in. pipe can be laid straight in a 12-in. wide trench.

Hot Jet Speeds Paint Removal

POWERFUL HYDRAULIC jet cleaning units are simplifying paint removal from paint spray booths and assembly fixtures at the Ford Motor Company's Rouge assembly plant. The hydraulic jet cleaners mix water with steam and detergent, under high pressure, to form a powerful jet discharge stream. Impact of the stream quickly and thoroughly removes unwanted materials from surfaces being cleaned.



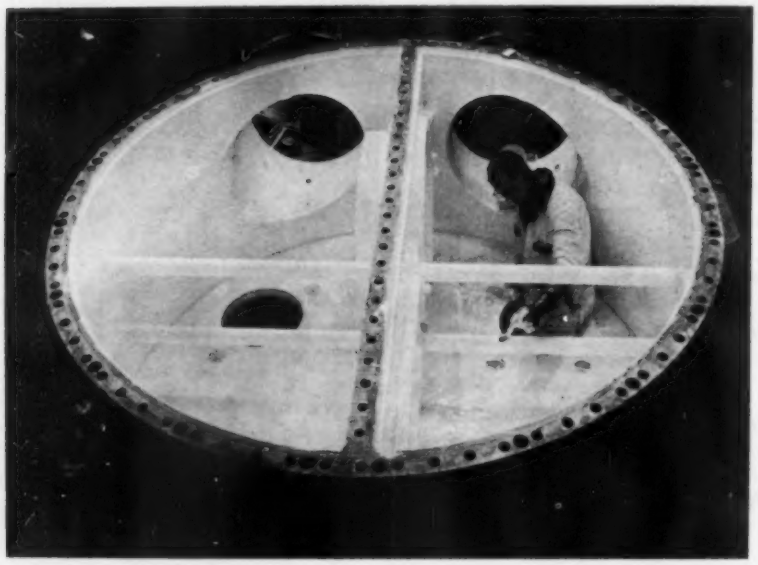
Jet spray blasts away unwanted paint as workman cleans metal floor plates.

Jet cleaners are now used at all of Ford's assembly plants to remove paint residue from spray paint booths measuring 60 by 120 ft. Cleaning of the booths is now completed in an average time of 45 minutes.

Hydraulic jet cleaning units, made by Sellers Injector Corp., are located at stations with pipe connections for cold water and plant steam. The units venturi-injector design boosts discharge pressure two to 20 times the input steam pressure. This provides the high cleaning impact needed and produces a solid jet even at 30 ft from the nozzle.

Effectiveness of cleaning is further increased by the high temperature of the stream, 190 F. Detergent is drawn from a storage drum in preset proportions through the automatic siphoning action of the injector. Since there are no moving parts in the system, maintenance costs are low.

Epoxy Coating on Condenser Water Boxes Extends Useful Life

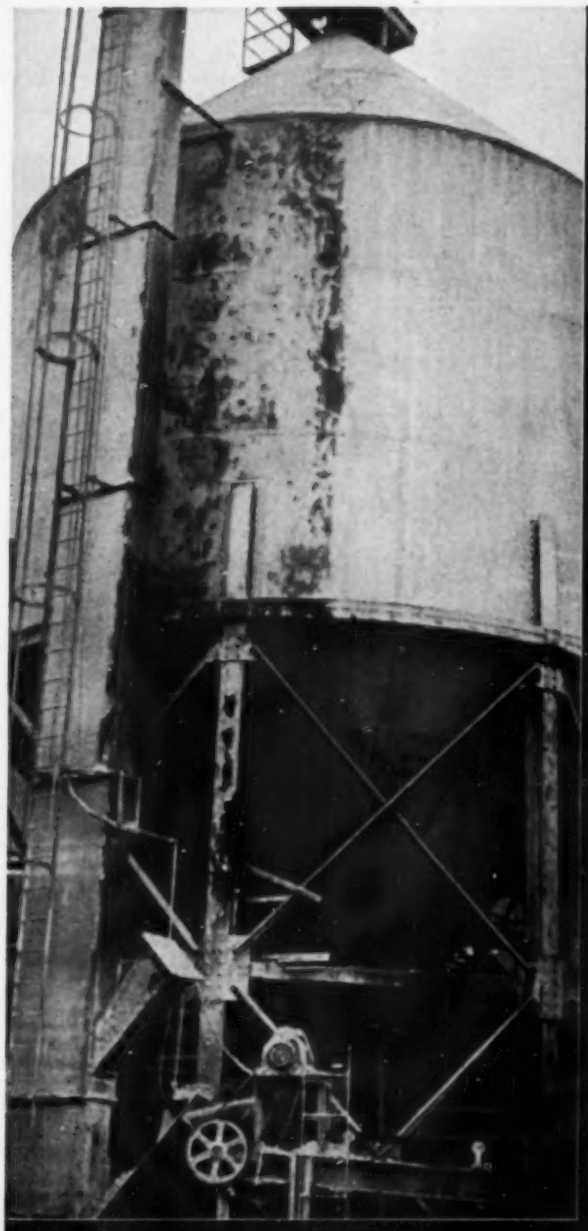


There is growing evidence that plastic coatings will contribute to longer condenser water box life. At Allis-Chalmers Mfg. Co., an experimental 1/16-in. epoxy-resin coating is brushed on the interior of a fabricated steel water box for a surface condenser being built for the Ohio Power Company.

Plastic Roll Saves $2000/Year

COST of back-up rolls used in die cutting machines at Royal Lace Paper Division, Standard Packaging Corp., Fort Wayne, Indiana, has been substantially reduced. Royal Lace replaced the Kraft paper back-up rolls with Polypenco MC Nylon, made

(Continued on page 60)



New Defense Against Corrosion

(and Mounting Maintenance Costs!)

Du Pont CORLAR(T.M.) Epoxy Enamels Afford Excellent Resistance to Chemical Spills and Fumes, Moisture and Heat up to 400° F.

Now a new kind of protective finish can help you solve *difficult* corrosion problems—and hold down skyrocketing maintenance costs. CORLAR Epoxy Chemical-Resistant Enamels combine excellent resistance to atmospheres containing mineral acids, alkalies, strong aromatic and aliphatic solvents with remarkable adhesion and heat resistance. They're also easy to handle, weather well, remain flexible at low temperatures.

Key to the success of these new coatings is a polyamide activator that binds molecules into a hard, firm film that literally *locks out* corrosion. Amide activator also makes CORLAR finishes safer to use and more stable; gives them 10-15 times longer pot life than amine types. Moreover, the epoxy resin's outstanding adhesion helps coatings stand off deterioration for years.

Two-package CORLAR Epoxy Enamels can be used indoors or out with equal success, apply easily with brush, roller or spray. Five standard colors are available, as well as black and white.

For prolonged exposure to severe mineral and organic acids, use Du Pont IMLAR(T.M.) vinyl coatings. See your local Du Pont sales representative for expert technical help. For more detailed information on these new finishes, clip and mail the coupon *today*.

Tested and proven on the job. After three years of continual exposure to corrosive fumes, moisture and salt spray, CORLAR coating on right side of lime tank is still in good condition. Commonly used phenolic resin coating on left side, however, has deteriorated completely—permitting rust and corrosion to take over.

CORLAR(T.M.)

Epoxy Chemical-Resistant Enamels

DU PONT

BETTER THINGS FOR BETTER LIVING...*THROUGH CHEMISTRY*

E. I. du Pont de Nemours & Co. (Inc.)
Finishes Division, Department PE-15
Wilmington 98, Delaware

Please send me, without obligation:

- ☐ Du Pont Technical Bulletin, "CORLAR Epoxy Chemical-Resistant Enamel"
- ☐ Du Pont Technical Bulletin, "IMLAR Vinyl Coatings"

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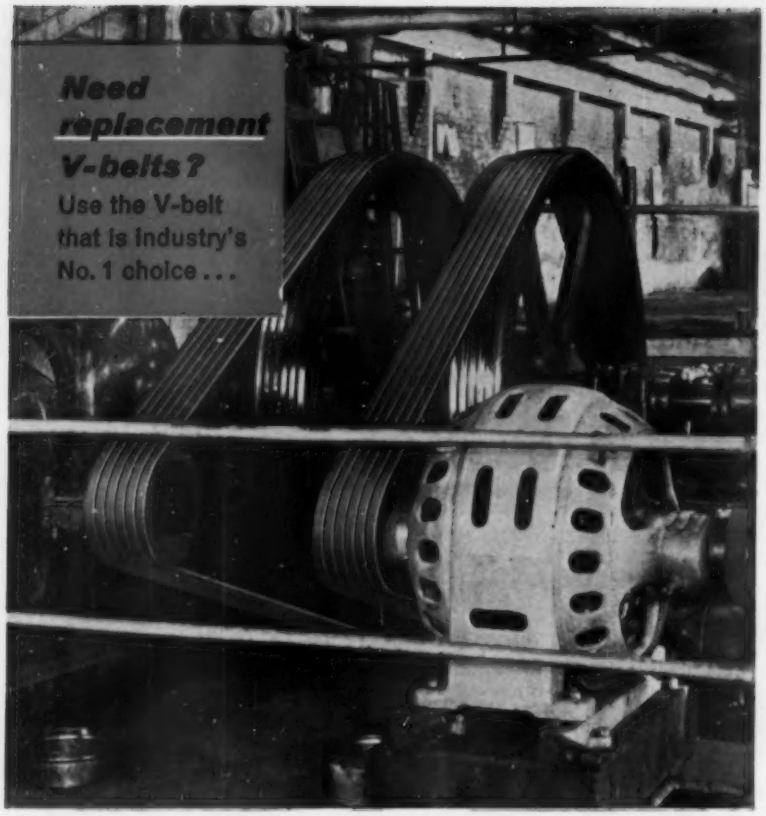
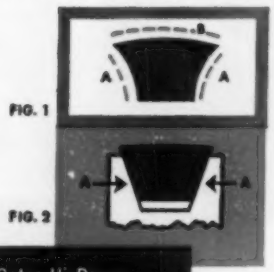


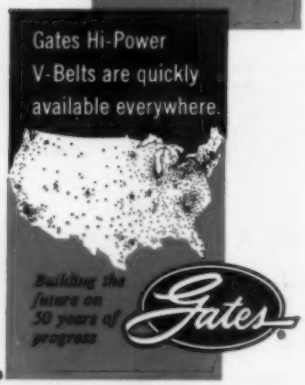
Gates Hi-Power V-Belts give you longer service life on your drives

Concave sidewalls (U.S. Pat. No. 1813698)—It is easy to see why Gates Hi-Power V-Belts give far longer belt life than ordinary V-belts. *Just make this simple test:* Bend a Gates V-Belt as if it were going around a sheave. Feel how the concave sides (Fig. 1-A) *fill out* . . . become perfectly straight (Fig. 2-A) to make *full contact* with the sides of a sheave. The belt thus grips the sheave evenly, and distributes wear uniformly across the sides of the belt, lengthening belt life.

Precisely-engineered arched top—The arched top (Fig. 1-B) of the Gates Hi-Power V-Belt prevents any distortion of the tensile section cords as the belt bends around the sheave . . . the load is uniformly distributed with each cord carrying its full share.

You will get fast delivery of Hi-Power V-Belts from the local stock of your nearby Gates Distributor. Call him today.





The Gates Rubber Company
Denver, Colorado

BP-8

Gates Hi-Power V-Belts

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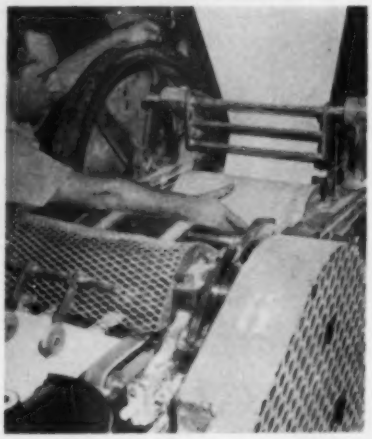
OPERATION—PRODUCTION

(O and P begins on page 56)



Nylon roll maintains smooth surface, outlasts paper rolls previously used.

by the Polymer Corporation, with a resultant savings of $2000 per machine in the cost of rolls alone. In addition, machine downtime was reduced, less scrap is produced and product quality is improved.

Previously-used paper rolls were made by compressing thousands of paper discs on a shaft and then truing the assembly in a lathe. Although basic material costs were low, the labor involved brought the cost of paper rolls up to $40 each. Paper rolls mark under the action of the knife edges and must be resurfaced by scraping several times a day. The average life of the paper rolls is one week.

Initially, nylon rolls are slightly more expensive. The seven-inch outside diameter tubular bar costs about $50. There is little additional labor as the nylon is heated to expand it slightly and then slipped onto an arbor. No extra pinning or keying is necessary as the shrink fit provides adequate adhesion between the arbor and the roll.

Instead of marking, as the paper rolls do under the impact of the cutting dies, the resilient nylon retains its smooth surface. One nylon roll outwears 50 paper rolls.

TV Monitors Boiler Flames

FIREWATCHING has taken on a new meaning at the Department of Water and Power in Los Angeles, California. Through the medium of a closed cir-

cuit television system, operators at the Department's Scattergood Steam Plant are able to maintain a constant watch on the fires inside the boilers from the control room.

Monitoring these boiler fires is essential to safe, efficient operation of the boilers. During firing startup the operator gets a clearer view of all 16 burners in each unit. He can see if every burner lights correctly and check for any plugged burner tips.

Prior to the installation of the industrial TV system, built by Kin Tel Division of Cohu Electronics, the Department had examined a number of other devices for indicating ignition in the boiler. No other device could keep track of all eight burners.

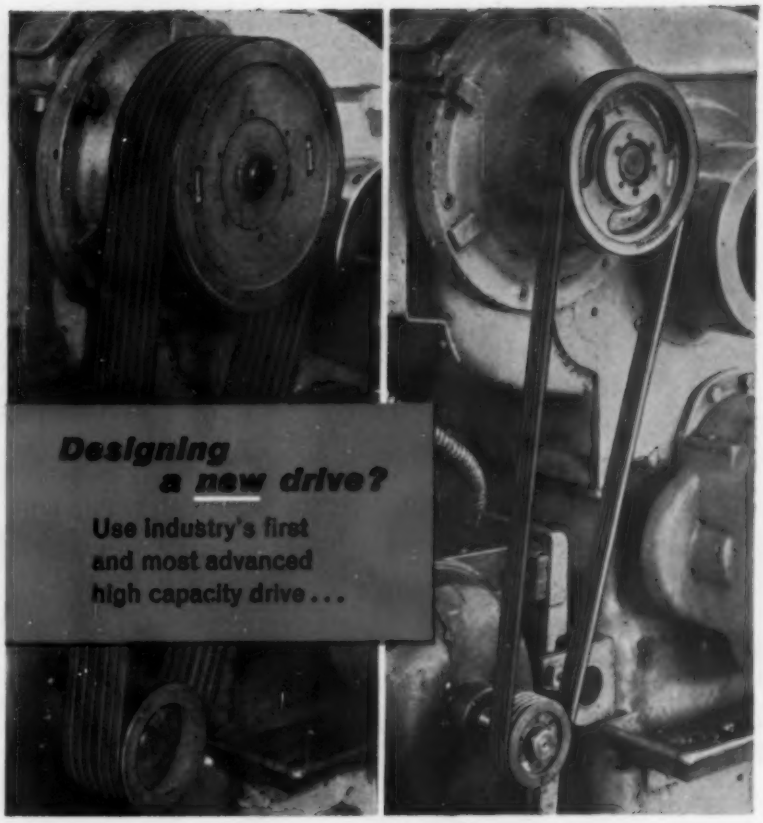
Operator monitors operation of eight burners on both sides of furnace by viewing screen of closed circuit TV.

The system that was finally installed uses four cameras mounted outside the boilers, directly opposite the burners. Two cameras are used on each boiler. An air-cooled window in boiler wall serves as viewing port.

A special feature of the installation is the filtering used on the camera to detect both oil and gas flames. Since the boilers are designed to burn either fuel, the camera is equipped with a special filter to show both the red flame of the oil and the nonluminous flame of the gas.

Roof Raised For Better Lighting

BUILDING PLANS at L. S. T. Typography, Chicago, Illinois, were changed at the last moment to increase the height of the roof 18 in. This change permitted the company to install a lighting system which pro-



Gates Super High Capacity V-Belts save drive space, weight, money

If you are designing a new drive, or if the belts and sheaves of a conventional V-belt drive must be replaced, you will benefit many ways by installing a Gates Super HC High Capacity V-Belt Drive.

Gates Super HC V-Belt unites new, high performance materials with a basic change in the shape of the belt itself. Because of this, it is able to handle up to 3 times the horsepower of a conventional V-belt in the same space. As a result, Gates Super HC Drives can often cut in half the space required for your drive. Drive costs are cut as much as 20%, and drive weight reduced 20% and more. Guards can be smaller. Bearing loads are less, increasing bearing life. And the drive can operate at belt speeds up to 6000 ft/min without dynamic balancing!

There is a Gates Field Engineer serving your area. To contact him for help in designing a new drive, call your nearby Gates Distributor.

Exclusive design features include: precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

Gates

Building the future on 50 years of progress

The Gates Rubber Company
Denver, Colorado

BP-7

Gates Super HC V-Belt Drives

For more facts circle 543 on Reply Card

ROYAL Portable Cords

are dependable, easy working, made right to be right on every job, time after time after time. Royal is the BIG line, too . . . rubber, neoprene and thermo-plastic, as well as lamp cords, fixture wires, machine tool wires, thermo cables, bell wires, coaxial cables, and more. All packaged for fast, easy identification. So when you buy wire and cable, specify ROYAL, the line that's preferred by electrical men everywhere. See your wholesaler, or write for catalog, giving wholesaler's name.

ROYAL ELECTRIC ...an associate of LTT

ROYAL ELECTRIC CORPORATION
PAWTUCKET • RHODE ISLAND
In Canada: Royal Electric Company (Quebec) Ltd.
Pointe — Claire, Quebec

For more facts circle 544 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 56)

vides the high quality and quantity of light recommended by lighting authorities for difficult seeing tasks. Designed to provide 200 fc, the lighting system features General Electric's Power Groove fluorescent lamps.

Fixtures are low brightness units of anodized aluminum with 35-degree shielding and a 42 per cent uplight component. They are mounted in continuous rows on eight-foot centers at a height of 11 ft. The raised ceiling has a height of 12 ft, eight inches.

In spite of the relatively low mounting height of the fixtures, light-

Continuous rows of shielded fixtures provides 200 fc in this modern plant.

ing levels are virtually uniform at work level between rows of fixtures. Linotype machines are oriented in the room so that operators view fixtures from the sides providing maximum seeing comfort.

Supplementary lighting, historically employed by linotype operators, is not needed because of the high level of general lighting. Emergency incandescent lighting is provided as required by the city code.

Contributing to the quantity and quality of the lighting, pastel colors are used on ceilings, walls and structural members. The floor of the plant is of wood block construction.

Adhesive Cuts Assembly Cost

BONDING two mating manifold sections together with adhesive instead of assembling with conventional fas-

This smart-looking, modern reception room and office has a distinctive rose-colored China Blend "K&M" Corrugated Asbestos-Cement Panel, with partitions in bright yellow and bone white "K&M" Flat Sheets.

"K&M"® COLORED STRUCTURAL SHEETS

The eye-appeal of color... the durability of asbestos-cement

Now, you can combine utility with decorative appeal by the use of "K&M" Asbestos-Cement Structural Sheets with the new "KolorMate" Finish.

These hardy, fireproof sheets retain all the ruggedness and durability of plain asbestos-cement sheets. However, 15 striking colors make them as good-looking as they are tough. They open up for you an unlimited range of decorative possibilities as siding, soffits, facades, marquees, office and shop partitions, and wall trim, to name but a few applications.

Under rigorous testing in K&M's research and development laboratories, these colors did not blister, peel, yellow or fade. Their "KolorMate" baked-on acrylic finish, developed exclusively for "K&M", bonds securely to the surface. This smooth, semi-gloss finish won't crack or chip during installation . . . can be scrubbed repeatedly without damage.

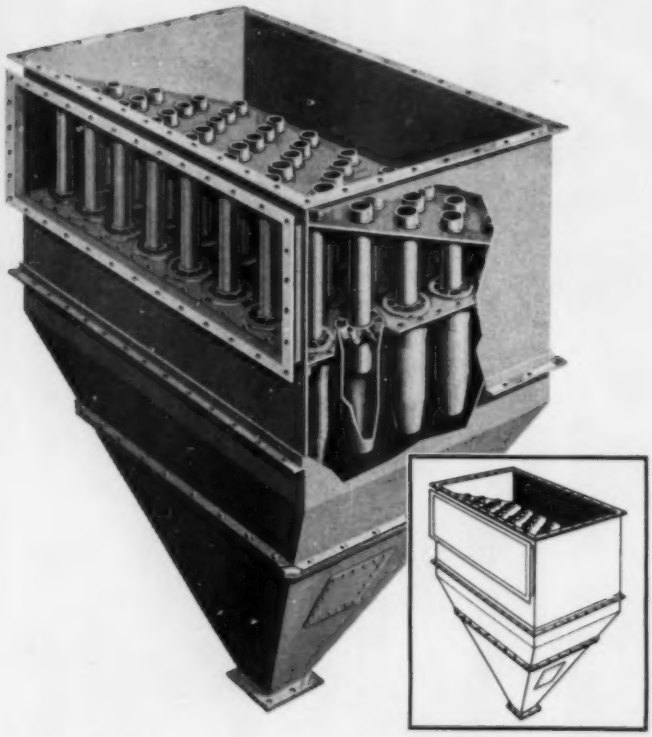
Write today for more information on "K&M" Asbestos-Cement Sheets with "KolorMate" Finish to: Keasbey & Mattison Company, Ambler, Pa. Dept. B-4651.

K·M
BEST IN ASBESTOS

Keasbey & Mattison at Ambler

For more facts circle 545 on Reply Card

New Ideas On Dust And Fume Control



New Products:

John Wood Improved Cyclone Collector

New collector tube and inlet vane designs in the John Wood Cyclone Collector result in sharply increased operating efficiency. These improvements enable the John Wood engineered equipment to provide the uniform gas flow to each cyclone and to assure the high centrifugal force necessary to remove even the smallest particle sizes.

All steel construction and 9" diameter cast tubes and vanes mean high resistance to high temperatures and severe abrasion. A full range of special casting materials meets even the most severe requirements. John Wood Cyclone Collectors are compactly designed and simple to install. Several duct connections and a wide variety of tube arrangements are available to handle gas volumes up to several hundred thousand CFM.

New Engineering: The complete line of John Wood equipment also includes Flooded-Bed Scrubbers, Venturi Scrubbers, Involute Cyclones, Fabric Filters and combination units. Extensive John Wood laboratories are available for advanced research on your air pollution problems.

New Service: John Wood Air Pollution Control is fully programmed from analysis of existing conditions to equipment installation. Frequently economies result that make the installation self-liquidating through lower maintenance and replacement costs.

Write for engineering assistance or specific product information. An air pollution preliminary analysis kit is available without obligation.

AIR POLLUTION CONTROL DIVISION
JOHN WOOD COMPANY
2 NICOLET AVENUE FLORHAM PARK, N. J. TUcker 7-3200

For more facts circle 546 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 56)

teners and sealers has reduced production costs over 50 per cent per manifold assembly at Taylor Instrument Company, Rochester, New York. The assembly is a pneumatically-controlled manifold used in a controller to control a wide range of process variables.

Adhesive assembly techniques permitted use of lower cost materials and virtually eliminated field failures and rework of rejected assemblies due to leaking. The two manifold sections are bonded and sealed with die cut structural film adhesive made by the Adhesives, Coatings and Sealers Division, Minnesota Mining and Manufacturing Co. This film adhesive provides uniform thickness throughout the joint and continuous contact between mating surfaces thus sealing and bonding in a single operation.

The die cut adhesive film is sol-

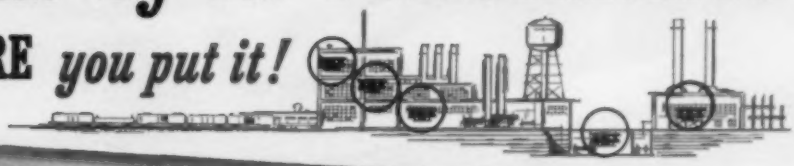
Two-piece manifold and film adhesive ready for final assembly and bonding.

vent-tacked to one mating manifold surface and the two manifold sections are assembled with plain steel screws. The entire assembly is then spray-painted with an epoxy enamel. The assembly is cured at 350 F for one hour, curing both the adhesive film and the enamel.

Because of the high strength of the bonded assembly, over 3000 psi, the screws could be removed after the curing operation. This is not normally done, however, because the labor cost of removing the screws exceeds their value.

Conspicuous by its Performance

...no matter WHERE you put it!



Clark Model CMB-2 Balanced/Opposed Air Compressor rated at 400 bhp. Models available from 75 to 8000 bhp.

CLARK
Balanced/Opposed
AIR COMPRESSOR

Air Power—100 lb. Variety—The kind that is economical, dependable... That's what you get with a compact Clark Balanced/Opposed Air compressor. You may hide it in the basement or the boiler room, but this smooth running veteran will always be conspicuous by its performance.

Efficiency at All Key Points—Compressor cylinders utilize large, streamlined air passages and optimum number of valves to minimize pressure drop, turbulence and valve losses. The heavy duty *Simplaire* valve has only one moving part on the low pressure suction side. Its webbed disc valve ring is opposed by minimum spring force, operates with less total differential pressure than any other compressor valve design. The Clark intercooler is carefully engineered for highest possible heat transfer rates. Double wall construction provides a large surge chamber to minimize pressure drop and assure maximum delivery of air.

A Real Space Saver—Squeeze it into "impossible" places... install large amounts of horsepower in limited areas. Compact Clark design with overhung integrally supported rotor makes the most of available space, eliminates bulky extension shafts with outboard bearings and flywheel.

Perfect Running Balance—Clark Balanced/Opposed design cancels out primary and secondary unbalanced forces. Units run smooth and quiet, thereby easing wear on moving parts. Foundations need only be large enough to support the physical weight of the compressor. You can locate a Clark machine anywhere... with confidence.

Low, Low Maintenance—Internal components are easy to get at, easy to service. Clark *Simplaire* valves are ultra simple in design, can be readily installed, or disassembled and cleaned. Valve bodies and housings of like size are completely interchangeable for suction or discharge, offer no alignment problems.

Put Greater Efficiency into every compressor dollar you spend. Contact your nearest Clark representative for full details, or write for Bulletin 185.

CLARK

DRESSER INDUSTRIES INC.

OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

CLARK BROS. CO., OLEAN, N.Y.

For more facts circle 547 on Reply Card

For more facts circle 548 on Reply Card ➔

Day-Brite PARAFLO® Troffers with patented PARALOUVERS® simplify ceiling appearance and planning by eliminating the need for separate air diffusers . . . deliver 100 footcandles with a minimum of glare. PARAFLO Patent Nos. 2,845,854 - 2,845,855 - 572,565 - 575,897 PARALOUVER Patent Nos. 26,833,799 - 507,541

Sleek fixture appearance complements modern wall treatment throughout building.

Pure Oil Company Building, Palatine, Illinois
Architect: *Perkins & Wills;* Electrical Contractor: *Kelso Burnett Co.*

Who goofed and forgot the air diffusers?

Nobody goofed.

In fact, very *special* attention was given to assure Pure Oil Co. employees the finest in year 'round comfort. Day-Brite combination lighting-air diffusing fixtures deliver lighting, cooling, heating and ventilation — all through the same outlet.

The result is an attractive, efficient working environment with . . .

High-level, low-glare Day-Brite lighting for better vision;

More uniform air distribution, thanks to the many diffusing sources;

And clean, uncluttered ceiling appearance.

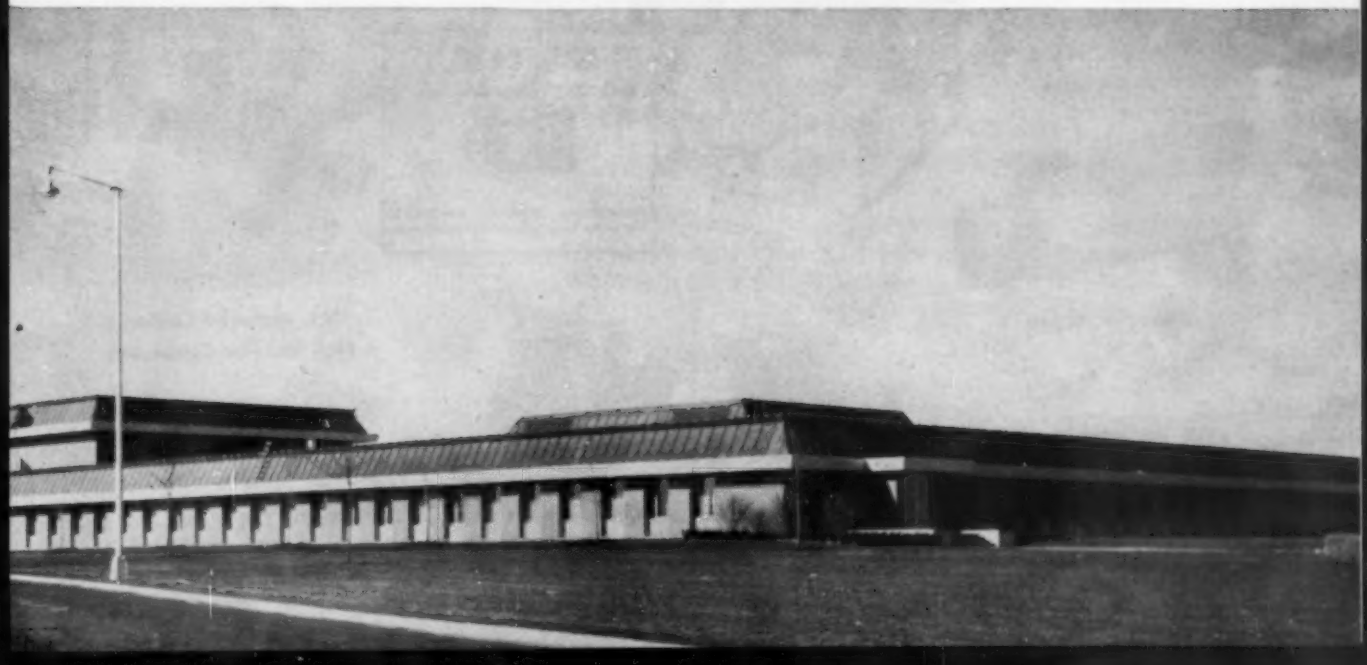
A full year was spent pre-testing these Day-Brite fixtures from every possible angle, including ease of installation and maintenance. Now in operation, Pure Oil Co. engineers report "complete satisfaction!"

For more information on how Day-Brite combination lighting-air diffusing fixtures can simplify your next ceiling plan, contact your Day-Brite representative listed in the Yellow Pages or write *Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis, Mo., and Santa Clara, Calif. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ont.*

Write for FREE booklet on Comfort Conditioning with Light and Air: Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo.

DAY-BRITE®

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT



Malleable Iron Liquid-Tite Connectors

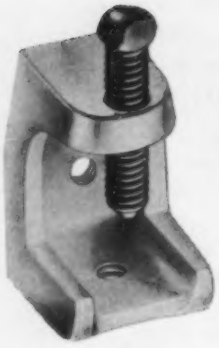
QUALITY MALLEABLE IRON FITTINGS ARE AVAILABLE!

GEDNEY'S

Complete Line is Precision-Made of Unbreakable Malleable Iron . . .

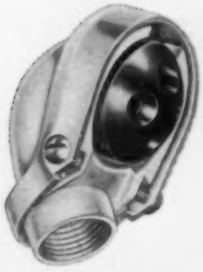
- *Unmatched for Toughness*
- *Impervious to Corrosion*

GEDNEY FITTINGS FIT



M.I. Beam Clamps

M.I. 90° Corner Adapters and Corner Elbows



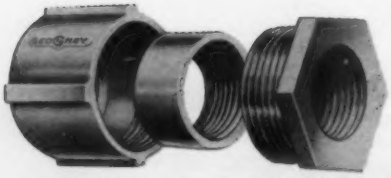
M.I. Entrance Caps

M.I. Offset Connectors and Offset Nipples

M.I. Insulated Bushings

M.I. Conduit Bodies

M.I. Armored Cable & Non Metallic Connectors



M.I. 3 Piece Conduit Couplings

For more facts circle 549 on Reply Card

COMBINES...

Fulflo

Honan-Crane

Delpark

Michiana

IN THE BROADEST LINE OF INDUSTRIAL FILTRATION EQUIPMENT

Stop in at the CFC booth (#214) at the Design Engineering Show in Detroit and see the complete selection of CFC filters.

From Air to Zinc Cyanide — a CFC filter is installed on every type of industrial filtration job. Ranging from a 5 CFM FULFLO air filter to automated DELPARK coolant filters for central systems handling hundreds of pounds of sludge every hour, CFC equipment is used for every filtration operation — for air, oils, coolants and chemicals.

CFC filters are the choice of industry because they have been proven under diverse and critical operating conditions . . . because CFC has 25 years of design engineering experience in every type of filtration . . . because, from over 4311 standard models and media, plant and design engineers can be sure they will get the best filter available, at the lowest cost.

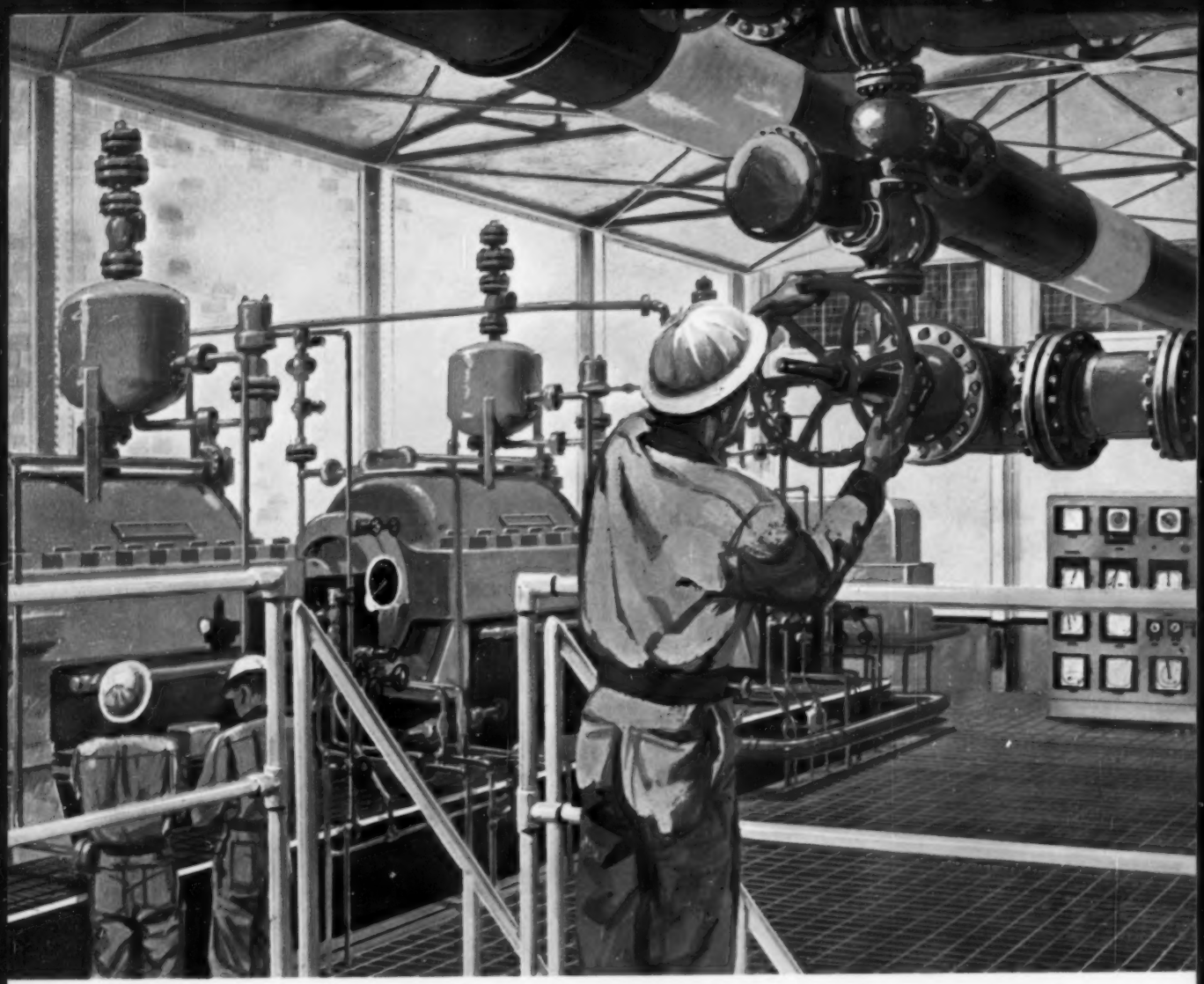
COMMERCIAL FILTERS CORPORATION

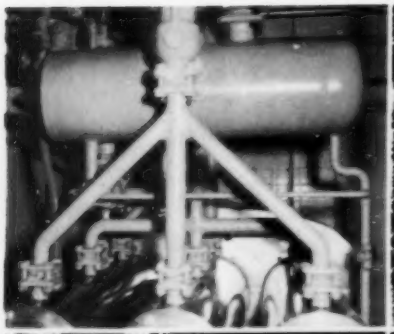
MELROSE 76, MASSACHUSETTS

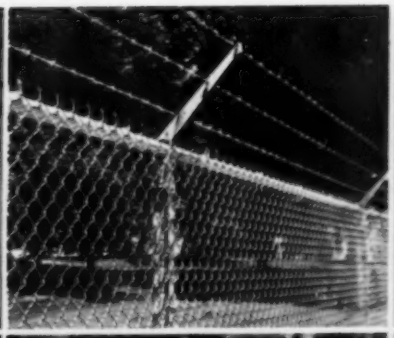
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

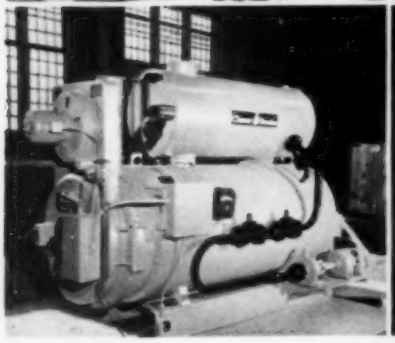
For more facts circle 550 on Reply Card

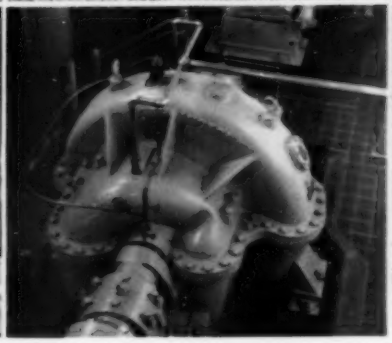
For more facts circle 551 on Reply Card

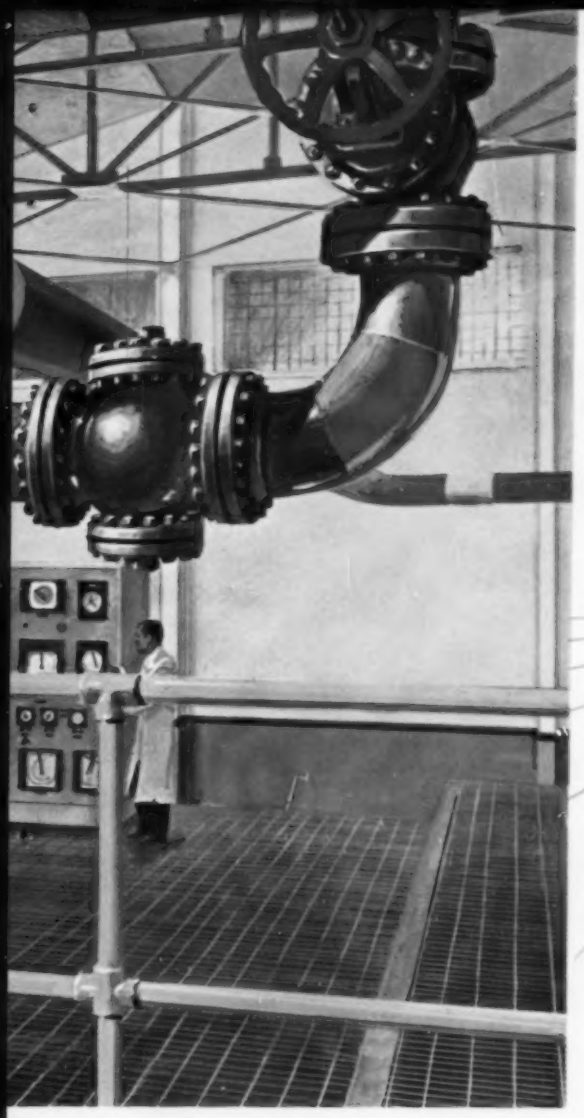












Rust-Oleum

NEW COLOR HORIZONS

System

HERE is a modern, functional *system* that combines four important points. (1) the ability to stop rust, (2) modern color harmony, (3) durability to last and last, (4) ease of application. From machinery, equipment, and structural steel to tanks, steel fences and metal sash – the Rust-Oleum New Color Horizons System can provide lasting beauty in the colors of your choice. Ask your Rust-Oleum Industrial Distributor, together with your Rust-Oleum Factory Specialist, to make a survey of your plant and provide complete recommendations. Rust-Oleum Industrial Distributors maintain complete stocks for prompt delivery in all principal cities of the United States, Canada, and in many countries around the world.

Rust-Oleum, in its various forms, can also save you time and money on problems like these: Heat Resistance, Water Resistance, Chemical Resistance, Coating Galvanized Metal, Speedy-Dry Coatings (less than thirty minutes to dry).

PROVED THROUGHOUT INDUSTRY FOR OVER THIRTY-FIVE YEARS

RUST-OLEUM®

See our catalog in Sweet's.

STOP RUST by applying Rust-Oleum 769 Damp-Proof Red Primer directly over the sound rusted surface

Save time, money, and metal. Brush Rust-Oleum 769 Damp-Proof Red Primer right over the remaining sound rusted surface after scraping and wirebrushing to remove rust scale and loose rust. **Specially-processed** fish oil vehicle penetrates rust to bare metal as proved in radioactive tracing studies.

STOPS RUST!®

Distinctive as your own fingerprint. There are imitations, but only one Rust-Oleum.

Insist upon industry-proved Rust-Oleum. Accept no substitute.

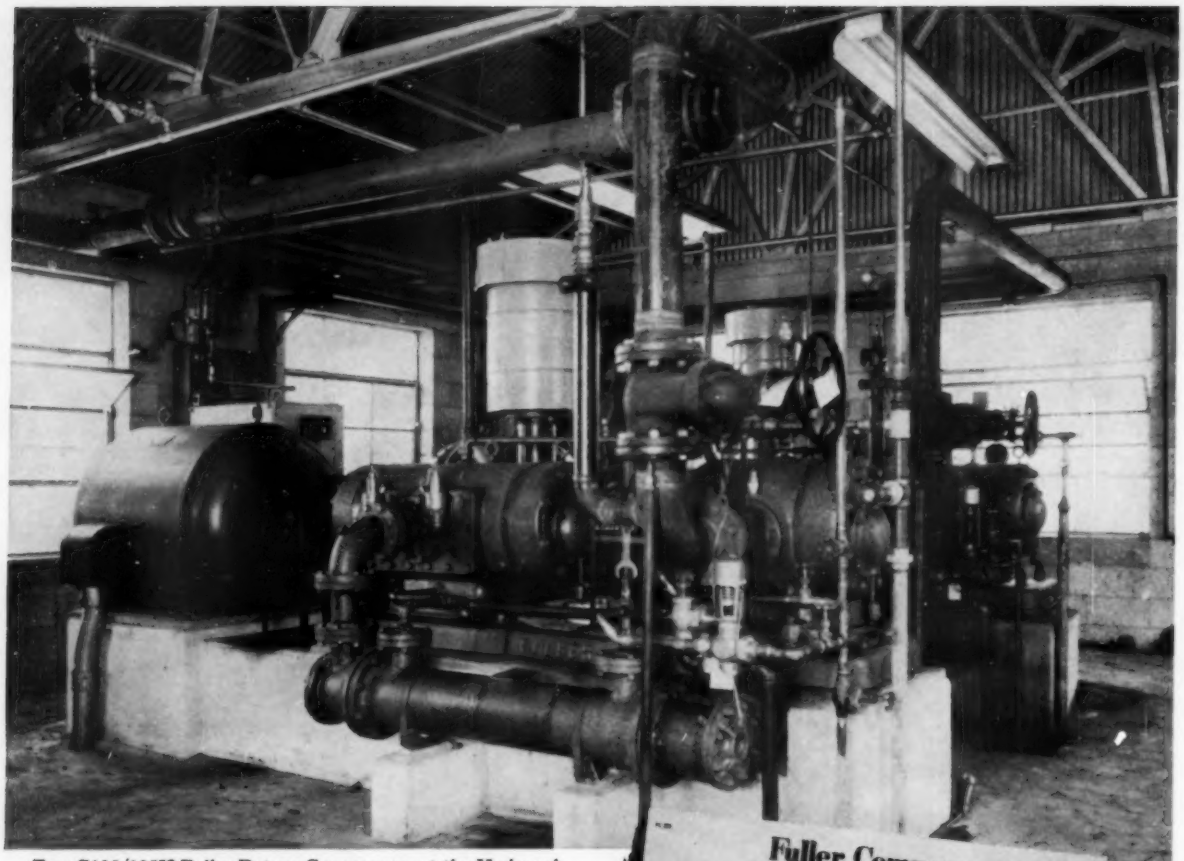
You take the brush! Try a free test sample!

ATTACH TO YOUR LETTERHEAD

RUST-OLEUM CORPORATION
2985 Oakton Street • Evanston, Illinois

At no cost or obligation, please send me:

- ☐ New full-color catalog on New Color Horizons System and specialized Rust-Oleum systems, including color charts and applications.
- ☐ FREE TEST SAMPLE of Rust-Oleum 769 Damp-Proof Red Primer.
- ☐ Please have your representative contact us to discuss a plant survey.



Two C135/135H Fuller Rotary Compressors at the Herbrand Division of the Bingham-Herbrand Corp., Fremont, Ohio, leading manufacturer of forged mechanics' hand tools and steel forgings for the automotive industry. Each compressor is rated 680 cfm, atmosphere to 100/110 psig., at 690 RPM.

Here's the 4-Year Maintenance Bill on Fuller Rotary Compressor at Herbrand Division of Bingham-Herbrand Corp.

So satisfactory was the performance of its first Fuller Rotary Compressor, installed in 1956, that Herbrand Division installed another like it 3½ years later.

When the older unit was inspected after four years operation, no replacement of parts was necessary. After installation of a new gasket (cost $9.35)—to replace the one that had to be removed to make inspection—the compressor continues to add to its service record.

The newer compressor has also been entirely trouble-free, and Herbrand plans a third, when increased air capacity is required. It, too, will be a Fuller—for, as Herbrand says, "These compressors can be classified as maintenance-free."

Because Fuller Rotary Compressors are practically vibration-free, they can be installed without complicated or expensive foundations or structural modifications. They are simple and efficient, with no valves to leak, no seats to grind. Blades automatically compensate for wear. They have forced-feed lubrication to all parts within the cylinder. Rotor, bearings and blades are the only moving parts.

Fuller Compressors range from 30 to 3300 cfm, pressures to 125-lb. gauge.

Write for Bulletin C-5A. It tells the whole story.

See Chemical Engineering Catalog for further details and specifications.

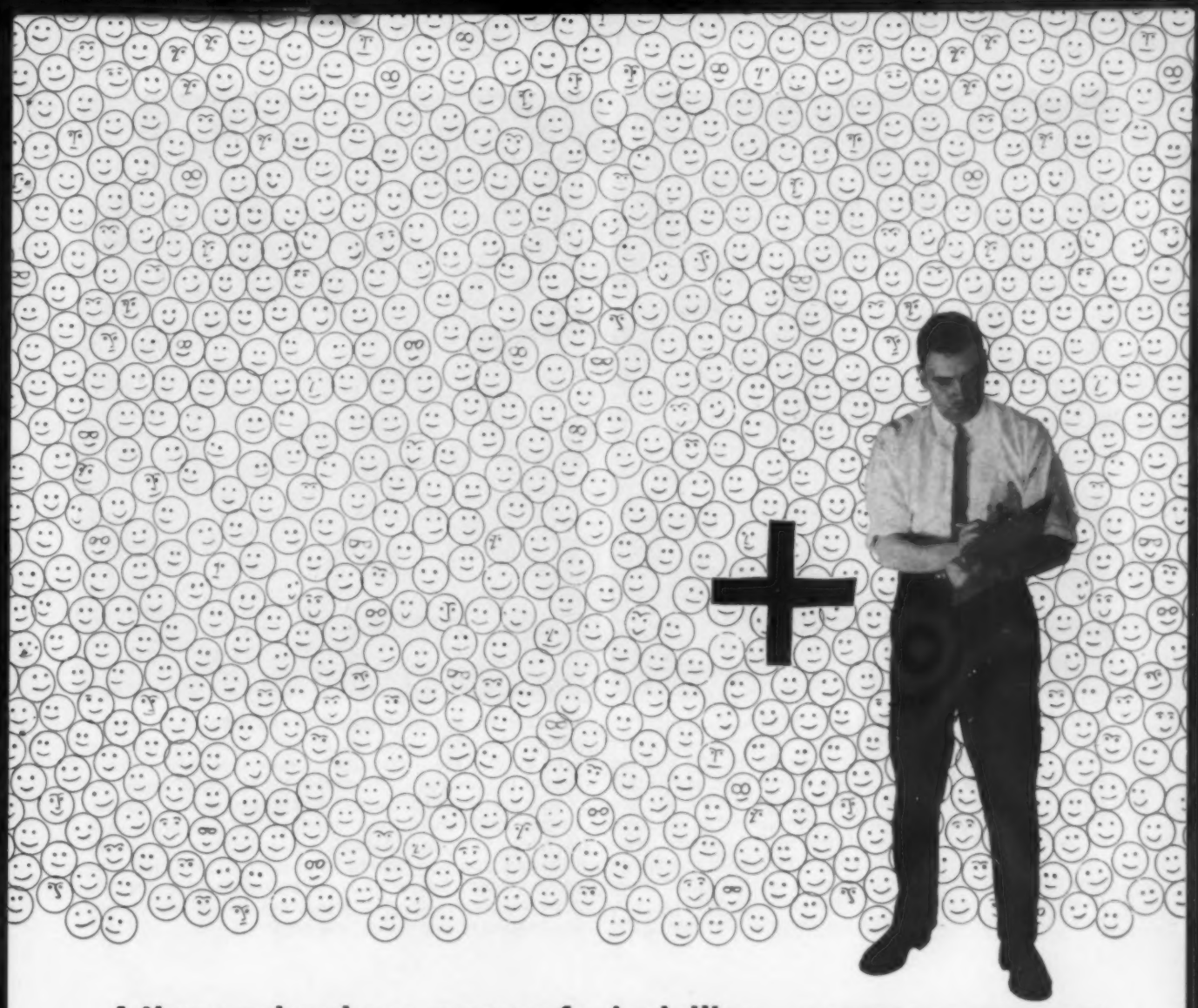
FULLER COMPANY GENERAL AMERICAN TRADE MARK

FULLER COMPANY
138 Bridge St., Catasauqua, Pa.
Subsidiary of General American Transportation Corporation
Offices in Principal Cities Throughout the World

Fuller
....pioneers in harnessing AIR

2852
C-364

For more facts circle 552 on Reply Card



A thousand and one reasons for installing

USS Multigrip Steel Floor Plate

If you have a thousand employees you have a thousand reasons for installing USS Multigrip Safety Floor Plate. But accidents can happen to anyone, so you'll be protecting yourself, too. Covering all the danger spots in your plant may prevent costly accidents. The riser pattern on USS Multigrip is scientifically designed to give positive traction in all directions, wet or dry. And Multigrip has no closed pockets to collect dirt and water—it sweeps clean in a stroke.

Multigrip protects floors, too. These rugged, heavy-duty floor plates will take the pounding of heavy traffic year after year with little wear or maintenance. Multigrip can't chip, splinter, or crack. It comes in ⅛" to ½" thick plates up to 600 inches long, so is easy to install without waste. Your Steel Service Center representative will provide you fast delivery of any size Multigrip Steel Floor Plate. Contact him for more information or write United States Steel, 525 William Penn Place, Room 6294, Pittsburgh 30, Pennsylvania.

This mark tells you a product is made of modern, dependable Steel.

United States Steel Corporation • Columbia-Geneva Steel Division • Tennessee Coal & Iron Division • United States Steel Export Company

USS TRADEMARK

United States Steel

SUN CUTTING OIL SAVES SIX WAYS. A typewriter manufacturer was producing pins, fasteners, and other parts from Bessemer screw stock on Brown and Sharpes and New Britain Gridleys. Finishes were poor, production slow, tool life below average. Work from cut-off was too hot to handle and there was excessive smoking. Analysis showed the cutting oil was deficient in antiweld and lubricity. Sunicut 11 Cutting Oil was recommended and its use resulted in immediate improvement in all trouble areas. In addition . . . savings on oil cost alone ran $6300 a year, proof that Sun quality does not mean a premium price!

SWITCH TO A SUN GREASE STOPS TROUBLE! A system of delicately balanced propellers produces the big wind in this huge transonic wind tunnel. Control mechanisms at the roots of the blades consist of several small sets of spur gears, antifriction bearings on gear shafts, and four 10-inch antifriction thrust bearings. *Oil* was being used for lubrication, but oil leaked . . . caused unbalance, violent vibration, gear and bearing failures. Sun 1897 *Grease* was recommended. An assembly was packed; leakage stopped. After 18 months, the Sun grease was still in service; not one bearing or gear failure had occurred!

Are you stymied by the question:

SUNOCO

QUALITY . . .

THE BEST ECONOMY OF ALL

Actually,
the answer is
simple enough:

SUN OIL COMPANY

HYDRAULIC OILS, SUNOCO SERVICE CUT LOSS! A molder of fiber glass products operates several plants. In one, leakage was causing frequent downtime of six presses molding fiber glass trays. A Sun man analyzed the trouble, recommended Suntac 302, one of the many Suntac oils designed to combat leakage in hydraulic and circulating systems. At another plant, production of boat hulls like the one shown here was stymied by a contaminated oil. The Sun man swung into action . . . brought in equipment to salvage the oil, saving a sizeable sum through *service*. Now job-fitted Sun Solnus 300 is *keeping* production rolling!

SOLNUS OIL CUTS MAINTENANCE 50%! A Pennsylvania manufacturer compared performance of his regular compressor oil with Sun Solnus 300 in a Chicago Pneumatic air compressor for two rigid test periods of eight months each. The Solnus 300 cut discharge valve maintenance from 4.12 manhours per month to 1.82, intake valve maintenance from 5.68 to 3.00, and all valve maintenance from 9.87 to 4.87 . . . maintenance savings of 50%. Dollar savings ran a tidy $915 a year! Where can your Sun Representative help you save with the quality performance of the right job-fitted Sunoco product for you?

Which petroleum product?

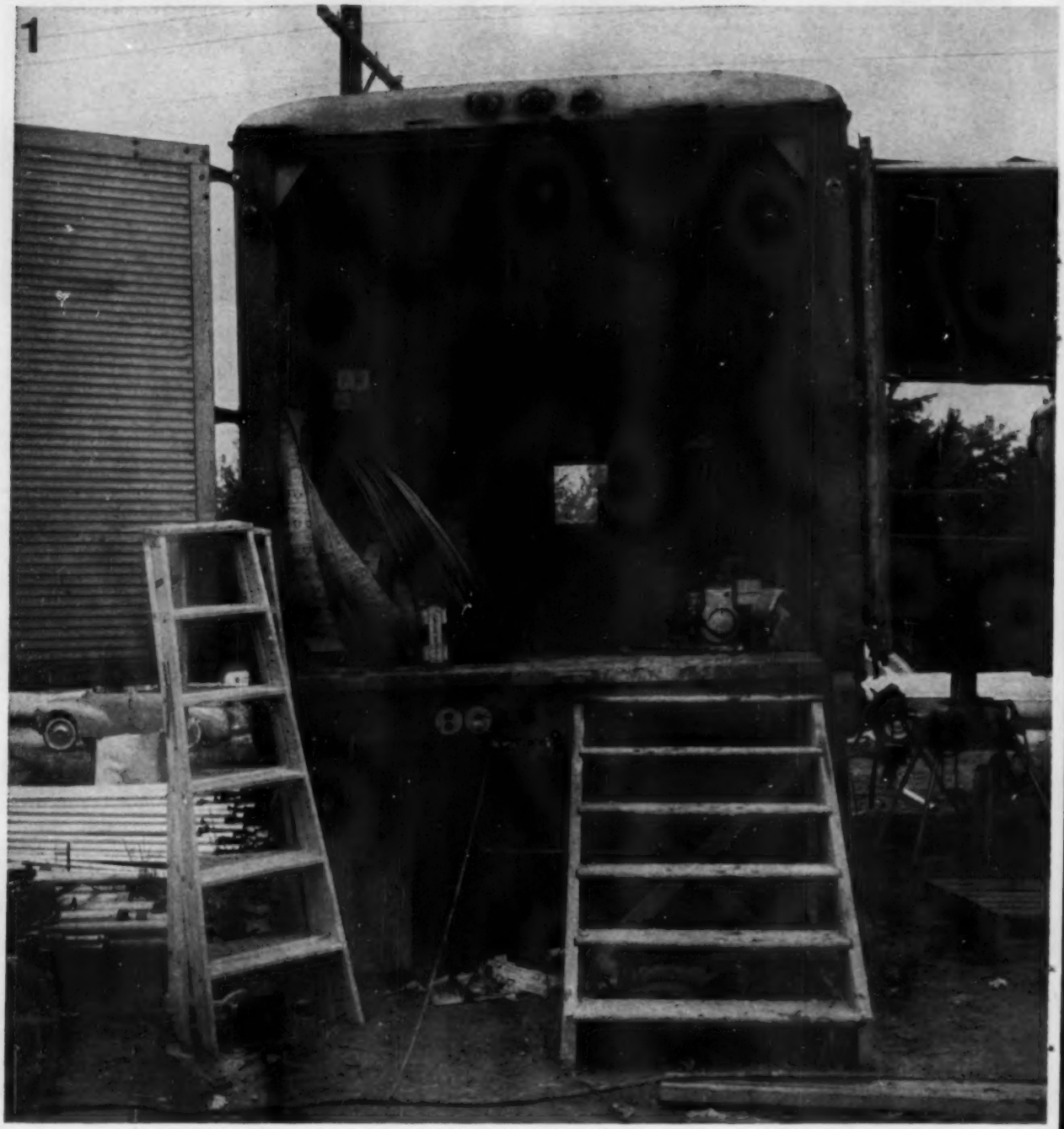
Get the *product quality* it takes to keep you rolling . . . job-fitted by men who *know what they're doing* . . . teamed with the *service* you have a right to expect! Try a Sunoco product in your plant. It's the fastest way to convince yourself that investing in Sun quality can be good for you.

PHILADELPHIA 3, PA., DEPT. PY-5 • **In Canada, Sun Oil Company Limited, Toronto and Montreal.**

For more facts circle 554 on Reply Card

Building new...modernizing

Nothing equals the versatility, quality and economy of Mineral Insulated Cable for jobs up to 600 volts! ☐ It's fast—MI Cable is rigid, yet so flexible electricians make even complex bends by hand, right on the job. ☐ It saves money: since MI Cable takes fewer man-hours to run—you get a better job quicker, at lower cost. ☐ It's safe—MI Cable is solid, ending problem of moisture, heat and

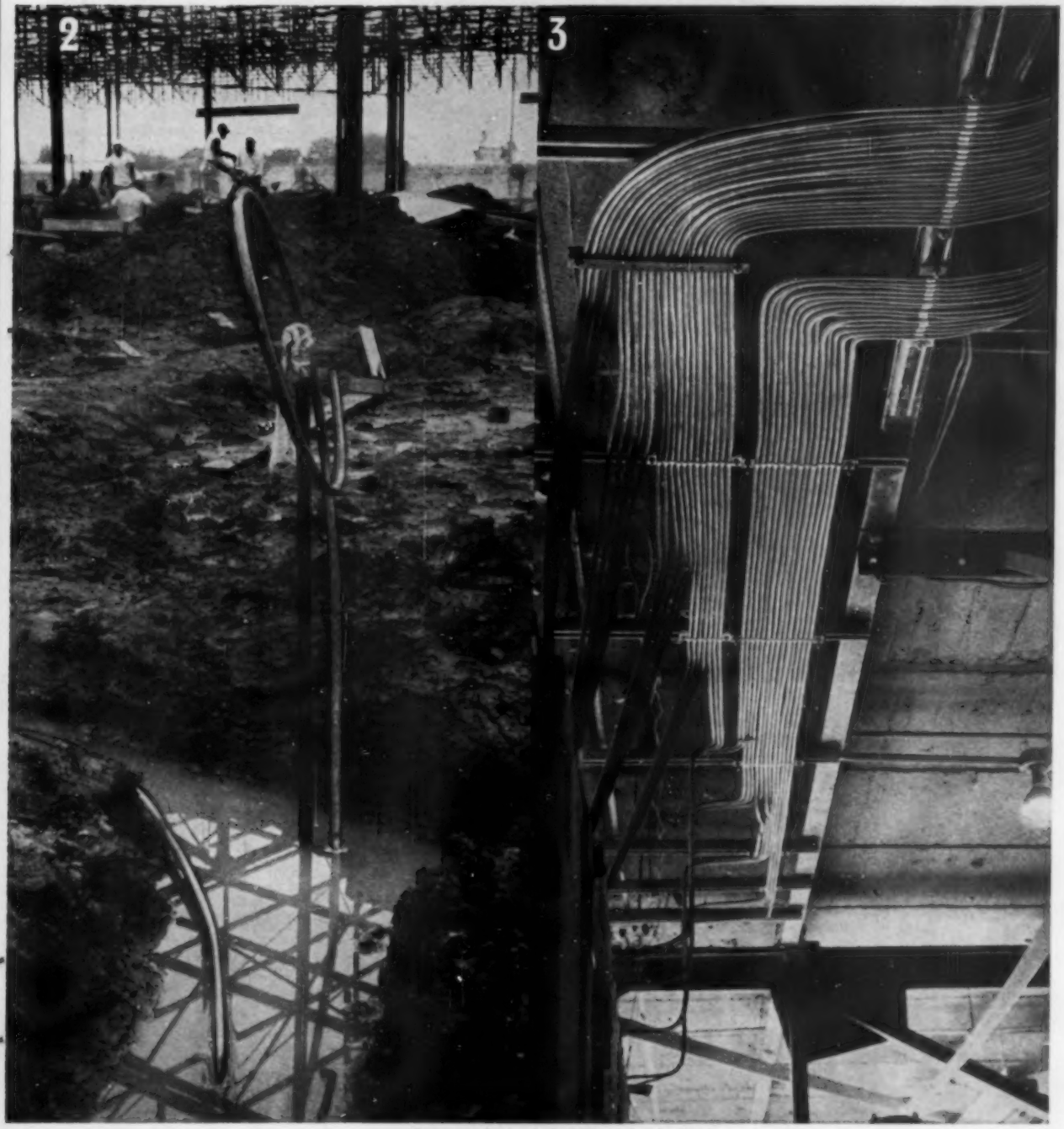


—good jobs call for MI Cable

explosion. ☐ Get the full details on MI Cable. Write for Catalog S-2. General Cable Corporation, 730 Third Avenue, New York 17, N.Y.

1 Your truck is a complete convenient shop for wiring any job with MI. 2 Only MI Cable could still be in perfect shape—without special protection—after weeks of rain that stopped all other work. 3 Compact—that's MI Cable. Here, 36 separate lines leave a motor control center in rewiring a paperboard plant.

GCC
GENERAL CABLE CORPORATION

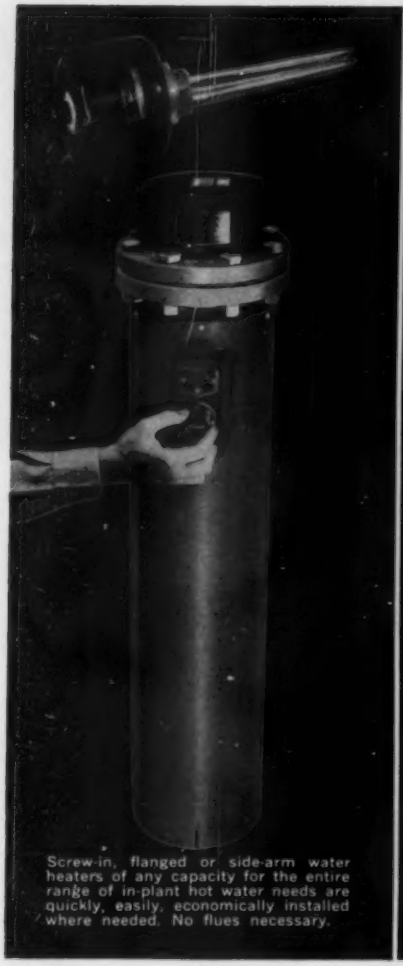


For more facts circle 555 on Reply Card

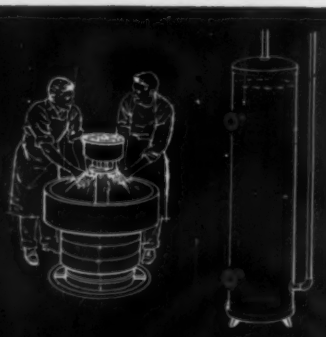
CHROMALOX ELECTRIC WATER HEATING UNITS

For hot water *anywhere* . . .

as much as you need . . . when you need it



Screw-in, flanged or side-arm water heaters of any capacity for the entire range of in-plant hot water needs are quickly, easily, economically installed where needed. No flues necessary.



For washroom and shower hot water—Chromalox Electric Heaters are easy to install, safe and economical.

Highly efficient Chromalox Electric Circulation Heaters automatically provide large quantities of water at controlled temperatures varying plant needs.

Chromalox Electric Immersion Heaters mounted on each end of hot water storage tank for an efficient shower.

At Your Service . . .

CHROMALOX "Answer Men"

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COURT DECISIONS —a summary of legal findings of interest to the plant engineer

Prepared by Albert Woodruff Gray

Sales or Services

ENGAGED IN THE production of steel castings, some of them standards and others made up on special orders, an Illinois corporation sued for a refund of taxes it had paid and which it claimed had been erroneously imposed under a Retailers Occupation Tax statute of that state.

Quotations and delivery information were sent out by the manufacturer based on blueprints supplied him by prospective buyers. When this manufacturer's bids were accepted, patterns were furnished by the customer for the castings desired.

Here the question before the court for determination was whether these activities were sales, as contended by the state, or merely services beyond the purview of this tax statute, as insisted by the manufacturer.

The court said, "If the article sold is the substance of a transaction and the service rendered is merely incidental to and an inseparable part of the transfer to the purchaser of the article sold, then the seller is engaged in the business of selling at retail and the tax which he pays for the privilege of engaging in such business is measured by the price which the purchaser pays for the article and the service incident thereto.

"This manufacturer is not primarily engaged in furnishing any technical engineering service apart from its general production 'know-how'. It is in the business of producing and selling tangible, personal property at retail in which the element of service is incidental. It is not in the business of furnishing services to which the materials employed and the services made are incidental." Court brief 130 N.E. 2d 262, Illinois.

Permanent Employment

OFFERS OF employment were made to a consulting engineer by both a university and a paper manufacturer.

Upon receipt of a telegram from the university asking an immediate decision of their offer, he telephoned the manufacturer and was told that if he would reject their offer and agree to purchase the home of the manufacturer's power superintendent he could have permanent employment with that company at $600 a month.

In the letter in which he confirmed his acceptance of the engineering job with the paper manufacturer, he wrote, "I feel the opportunities with you for applying my past experience are very attractive, the essential consideration being, however, that the job will be a permanent one."

Two years later he was discharged and sued this paper manufacturer for $25,000 which he claimed as damages for a breach of his contract for permanent employment. When the decision of this action was rendered, denying him a recovery, the Supreme Court of that state said, "In most of the jurisdictions passing on the duration of a contract purporting to be for permanent employment, it is held that in the absence of additional express or implied stipulation as to the duration of the employment or of a good consideration additional to the services contracted to be rendered, a contract for permanent employment, for as long as the employee chooses, or other terms purporting permanent employment, is no more than an indefinite hiring at the will of either party." Court brief 266 N.W. 872, Minnesota.

Exclusive Dealing Contract

SUIT WAS brought by a concrete products company for what was alleged to be a violation of a statute of that state that provided that any person injured by a trust such as that described in this statute, "may recover damages of every kind sustained by him or it." A trust according to that statute is an agreement to restrain trade or fix prices or production.

In its purchases of cement and related items, the orders of this buyer were, according to this contract, all placed with one who had organized the company and in turn ordered these items on his own account to be delivered directly to the company but billed to him. He then billed the company himself at cost plus 20 cents a barrel.

Verdict against this man was returned by a jury for $15,000 which the Supreme Court of that state refused to disturb on appeal. Court brief (C.C.H.) 1960 Trade Cases 77,155, Mississippi, September 19, 1960.

Illegal Price Maintenance

THE CATALOG of a drug manufacturer contained a Net Price Selling Schedule, listing suggested prices for its products to be charged by its wholesalers to retailers. Two retailers refused to maintain the prices set out in this schedule.

The manufacturer said that not only would it refuse to sell to wholesalers who did not agree to adhere to this price schedule, but it would also refuse to sell to any wholesalers who sold these products to retailers who did not, in turn, agree to observe the schedule.

As a consequence, the government sued charging the manufacturer with a violation of the antitrust laws. Condemnation of this marketing method was the subject of a decision by the United States Supreme Court in which it forbade a continuance of this marketing method.

"If a manufacturer is unwilling to rely on individual sale interest to bring about general voluntary acquiescence which is the collateral effect of limiting price competition, and takes affirmative action to achieve uniform adherence by inducing each customer to adhere to a price maintenance plan, the customer's acquiescence is not then a matter of individual free choice prompted alone by the desirability of the product.

"The product then comes packaged in a competition-free wrapping—a valuable feature in itself—by virtue of concerted action induced by the manufacturer. The manufacturer is thus the organizer of a price maintenance combination or conspiracy in violation of the Sherman Act." Court brief 80 Supr. Ct. 503, D.C. February 29, 1960.

Wage and Hour Exemptions

IN AN EFFORT to enjoin a Pennsylvania employer from an alleged violation of the wage and overtime provisions of the Fair Labor Standards Act, the Secretary of Labor charged that the operation of a so-called "shopping service" was within the scope of that statute.

This shopping service offered retail establishments the investigation of the honesty and efficiency of employees. Shoppers from the Pittsburgh area were employed by this service. It was their duty to enter different places of business pretending to be customers and observe the behavior, honesty and efficiency of sales employees of the subscriber.

Shoppers then prepared their reports which were delivered to their supervisor either personally or by mail and forwarded by him to the Pitts-

COURT DECISIONS

burgh office. Such services were conducted throughout western Pennsylvania, in eastern Ohio and in West Virginia and Kentucky.

In its defense, the employer argued that its business was exempt under the provisions of this statute that excluded from the wage and hour provisions retail establishments when (1) more than one half of the annual dollar volume of the sales of goods and services were made within the state where the business is located, (2) at least 75 per cent of the gross volume of sales of goods or services were not for resale and (3) at least 75 per cent of the sales of goods and merchandise were recognized as retail sales or services in the industry.

The Federal court decided that the operator of this shopping service was conducting a retail business and exempt from the Fair Labor Standards Act. "A sale of this shopping service as used by the buyer for its commercial benefit," said the court, "is analogous to a restaurateur purchasing a chicken, treating it and succulently preparing it in order to encourage more consumers and customers.

"The fact that this activity is extended for a commercial purpose would not render the restaurateur's business to be wholesale in character. I conclude, therefore, that despite the fact that this employer is engaged in commerce, which would render it subject to the provisions of the Fair Labor Standards Act, nevertheless, the employer is relieved from compliance for the reason that the activities fall within the specific exemptions enumerated in the Act." Court brief 182 F.S. 800, Pennsylvania, April 14, 1960.

Life Employment

A 67 YEAR old man had been employed as chief engineer of a utility company, and was receiving a salary of $300 a month.

In place of that contract it was agreed that he should receive $125 a month from the company for the remainder of his life. In return for this promise the engineer agreed to serve in the capacity of a consulting engineer and be at all times ready to act for the company. Further, that while he might under this agreement perform work for others as a consulting engineer the work of the utility company should in every case have preference.

Five years later the utility refused to continue this agreement and the engineer sued for what he alleged was a breach of contract. The utility, in its defense, claimed that this lifetime employment agreement lacked the consideration necessary for a valid contract and that the mere promise of the engineer to give a preference to the utility in any demand for his services was an insufficient consideration to support this agreement for lifetime employment.

In sustaining the agreement and the right of the employee to recover his damages, the federal court pointed out that the promise of the other party to give preference to any demand for his services by the utility—was a sufficient consideration to support an agreement of this sort and the engineer had the right to recovery. Court brief 165 Fed. 2d 339, Arkansas, January 15, 1948.

Merchantable Quality

FEATURED IN AN action before the Connecticut Supreme Court was the phrase "merchantable quality" as used in a statute of that state relating to implied warranties in the sale of goods.

That statute in part, was, "(2) When the goods are bought by description from a seller who deals in goods of that description, whether he is a grower or manufacturer or not, there is an implied warranty that the goods shall be of merchantable quality."

Of this phrase, the Connecticut court said, "This means that they shall be reasonably suitable for the ordinary use intended."

This same phrase has been defined also in two other recent decisions, one in California in which that court said, "Merchantable quality refers to goods which are reasonably suitable for the ordinary uses and purposes of goods of the general type described by terms of sale and which are capable of passing in the market under the name or description by which they are sold."

The other instance, in Massachusetts, where the court said, "The substance of statutory implied warranty that goods, bought by description from one dealing in goods of such description are of 'merchantable quality' is that goods shall be merchantable under the name by which they are described." Court brief 162 Atl. 2d 513, Connecticut, June 28, 1960.

Damages Waived

TWO COILS FOR air conditioning equipment were purchased by a subcontractor on a government building project from the manufacturer. On the first page of the price list of the manufacturer under the heading, "Conditions of Sale," was printed, "We are not responsible for damage to equipment in transit. Purchasers are warned against receipting for equipment before making careful inspection."

Two of these coils were damaged in shipment. When the government refused to accept them after they had been repaired, two others were ordered as replacements which, packaged in the same manner, were also damaged.

Suit was brought by the manufacturer for this equipment and the purchaser set up as a counterclaim the amount it had paid elsewhere for the coils it had substituted.

Faced with the stipulation printed at the top of the first page of the price list that the manufacturer would not assume any liability for damages to goods in transit, the purchaser argued that the sales contract consisted solely of the order itself together with the invoice and bill of lading and that this stipulation was not a part of the sales agreement.

The federal court in its decision said, "We believe that the statement as to risk of loss was clearly enough presented to the prospective customer so that the purchaser could no longer place an order with the manufacturer, saying nothing of the risk of loss. If the purchaser wished to contract differently, it should have negotiated expressly for different terms." Court brief 275 Fed. 2d 372, Mass., March 2, 1960.

Trade Secrets Distinguished

EMPLOYED AS sales engineer for over six years by a manufacturer of plastic extruding machines, this employee resigned and established his own business. During his employment he had become familiar with the production and sales features as well as the records, drawings, blueprints and other material of his employer.

In its suit to prevent the use of this information by the former employee, the employer alleged that the employee had made a wrongful use of confidential information and of the trade secrets of the employer.

The federal court ruled that there had been no use or disclosure of trade secrets of the employer. The court further stated:

"Even before the termination of the agency he was entitled to make arrangements to compete except that he could not properly use confidential information peculiar to his employer's business and acquired therein. He was not entitled to solicit customers for such lawful business before the end of his employment nor could he properly do other similar acts in direct competition with the employer's business." Court brief 185 F. S. 594, New Jersey, July 22, 1960.

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PAY TO THE ORDER OF John J. Doe, Anytown, U.S.A.
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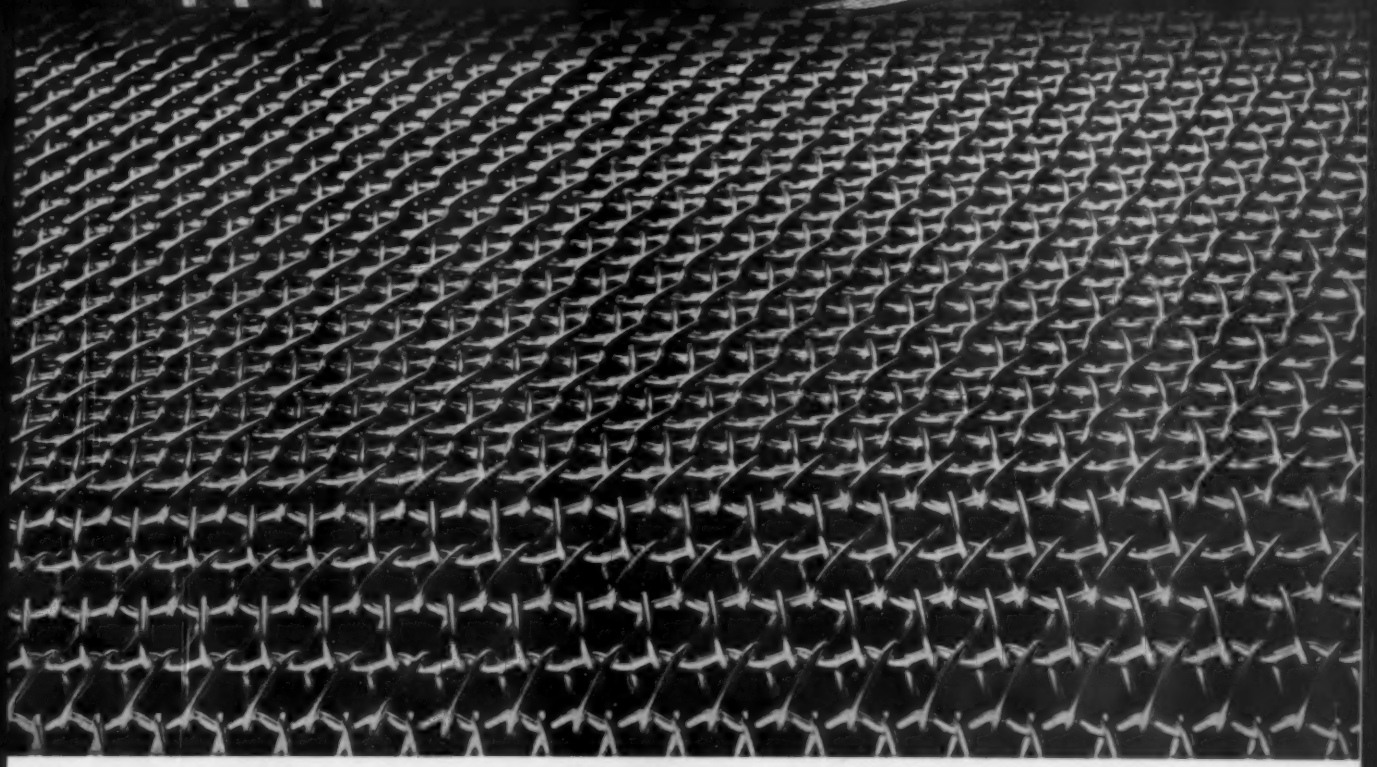

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A sales organization especially trained to serve industrial and fleet customers . . . 74 District Offices and 13 Regional Offices . . . 4,100 warehouses and distribution points . . . 12 refineries . . . more than 2,000 products to serve you . . . this is American Oil Company.

The American Oil Company representative who calls on you receives special training in servicing industrial and fleet customers at our Sales Engineering School. His training begins with a concentrated course in petroleum product quality and application. According to a planned schedule, he returns for an advanced course and then again for post-graduate work. From our Marketing Technical Service Department, your American Oil representative draws assistance, when needed, from specialists who are recognized authorities in their fields. These specialists may be called in at any time to work with you on your lubrication problems. More than a thousand research scientists and technicians at our research laboratory support the effort of our representative to serve you. Their mission: To help your American Oil representative help you lower your maintenance costs and stretch your maintenance dollars. Learn more about American Oil, its men, its service, its products.

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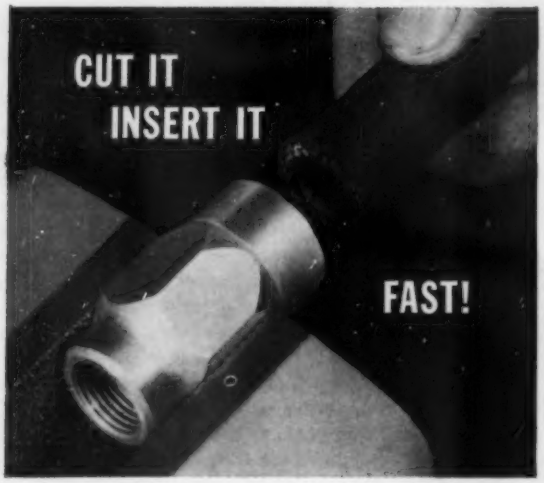
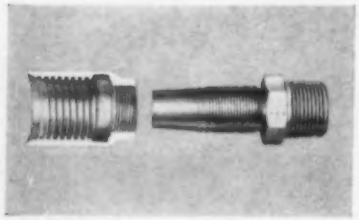
Save Hose Replacement Dollars.

Using PARKER Fittings with PARKER Hose to make Replacement Assemblies Faster



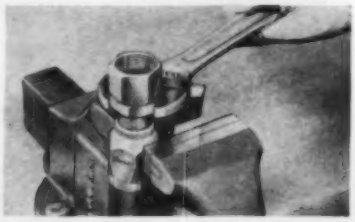
Installing Parker "Hoze-lok®" Fittings on Parker "No-Skive" Hose . . . NO SKIVING!

Installing ordinary fittings on ordinary rubber-covered hose . . . First, this messy skiving job.



Design of the "Hoze-lok" socket (left) makes the difference. The deep-tapped threads accept the **controlled thickness** rubber cover of Parker "No-Skive" Hose as they plow their way down to the wire braid of the hose. The rubber is displaced, not removed.

Just screw the hose in counter-clockwise, by hand. The rubber cover fills completely the space between each thread. It both protects and cushions the wire braid, eliminating a major cause of hose failure. A little Parker "Threadlube" is needed here.



The nipple, which is also the hose end fitting, screws in last, clockwise, in the usual way. You are now ready to make up the other end of your Parker No-Skive Hose Assembly. This method is not only faster; it gives you a better assembly. See next page.

You can install a Parker "Hoze-lok" Fitting on small-diameter Parker "No-Skive" Hose in 60 seconds. On 3/4" Parker hose, it takes 2 minutes or less. On very large sizes, allow 5 minutes per fitting. Hose replacement time is reduced to minutes the Parker No-Skive Way!

..*the* Parker No-Skive Way

Why Parker No-Skive Hose Assemblies Last Longer

BETTER PROTECTION FOR THE HOSE AT ITS POINT OF GREATEST STRESS

Most hose failures result from flexing. Ordinary hose, skived to the bare wire at the critical point where the first thread of the hose fitting bears directly on the wire braid, fails right there. As our picture shows, the leading thread of Parker "Hoze-lok" Fittings cannot reach the wire. The cushioning effect of the compressed rubber between the threads reduces the stress concentration at this point. Gripping by direct contact between the deep-tapped "Hoze-lok" threads and the wire braid occurs well within the fitting, where no flexing occurs.

Actual tests prove the effectiveness of this better design feature. Parker "Hoze-lok" assemblies on Parker "No-Skive" Hose rarely fail at the fitting, even when stressed to the burst point.

HOW PARKER DEVELOPED A BETTER HOSE TO MAKE THESE SAVINGS POSSIBLE

Parker "Hoze-lok" Fittings can be used with any hose, but you still have to skive ordinary rubber-covered hose, even with "Hoze-lok" fittings. Parker "No-Skive" Hose, however, is made to rigid specifications that limit and *control* the thickness of the cover to the exact amount of rubber that the corresponding size of "Hoze-lok" fitting will accept, when attached without skiving.

In all other characteristics, from the inner liner to the OD of the outermost wire braid, Parker "No-Skive" Hose conforms to S.A.E. specifications. In addition, because only a better grade of rubber compound can be extruded to Parker's exacting *controlled thickness* specification, the increased resistance to abrasion of the Parker "No-Skive" rubber cover results in a better hose.

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Parker FITTINGS AND HOSE DIVISION

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PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

ARRANGE NOW FOR A PARKER NO-SKIVE DEMONSTRATION IN YOUR OWN PLANT OR OFFICE

Gentlemen: We would like to see the Parker No-Skive Way to make up replacement hose assemblies demonstrated, without any obligation on our part, of course.

Please ask your salesman or nearest "Hoze-lok" distributor to get in touch with me:

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Title, Department or Division _____

Company_____

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We use hose for_____

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Simpler construction and fewer moving parts, combined with the vibrationless, rotary motion of the electric motors, make minimum repair and replacement on battery-powered electric trucks self-evident.

Add less maintenance to a convincing list of other benefits—lower operating costs, maneuverability, clean, quiet and safe operation—and you can easily see the main reason why users indicate a preference for battery-powered electric trucks for modern, efficient materials-handling jobs of all types.

Electric truck users generally agree on one other point, too—Gould Batteries for longer life. With the new Silconic Plate, Gould Batteries offer up to 25% longer life.

Join the list of users who prefer this ideal combination of electric trucks and Gould Batteries. For more information, write or call your local Gould representative. Ask for booklet "Why We Use Battery-Electric Industrial Trucks." Gould-National Batteries, Inc., First National Bank Building, St. Paul 1, Minnesota. In Canada, write to Gould-National Batteries of Canada, Ltd., 1819 Yonge St., Toronto, Ont.

***More Power to You from* GOULD**

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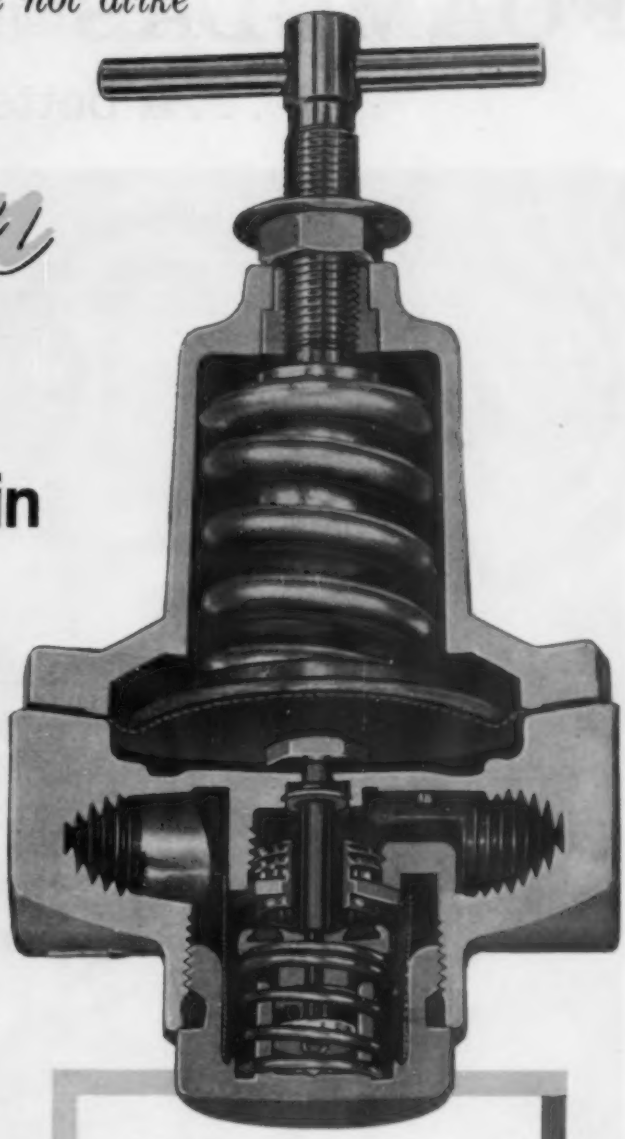
All Pressure Regulators are not alike

Norgren

Floating Valve-Pin

A Norgren extra that assures leak-proof seating of the regulator valve



A tight, leak-proof seating of the valve is essential to the proper performance of a pressure regulator. Leakage and creep can be caused by improper alignment of the valve-pin, resulting in gouges and excessive wear on the valve seats.

To prevent this, Norgren Regulators are made with a floating valve-pin, eliminating critical alignment problems. The Norgren floating valve-pin is self-aligning, assuring positive seating of the valve. As a result, there is minimum wear on the valve seat, with increased service life and more dependable regulator performance.

Whatever your pressure regulation need, there is a Norgren Pressure Regulator designed for the job. Call your nearby Norgren Representative listed in your telephone directory—or write factory for literature showing complete Norgren Regulator line.

Norgren Pressure Regulators give you these important features:

- Balanced Valve Construction—improved regulator performance
- Large Nylon-reinforced Synthetic Rubber Diaphragm—long service life
- Baffle and Siphon Tube—increased accuracy
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- Floating Valve-Pin—assures better seating

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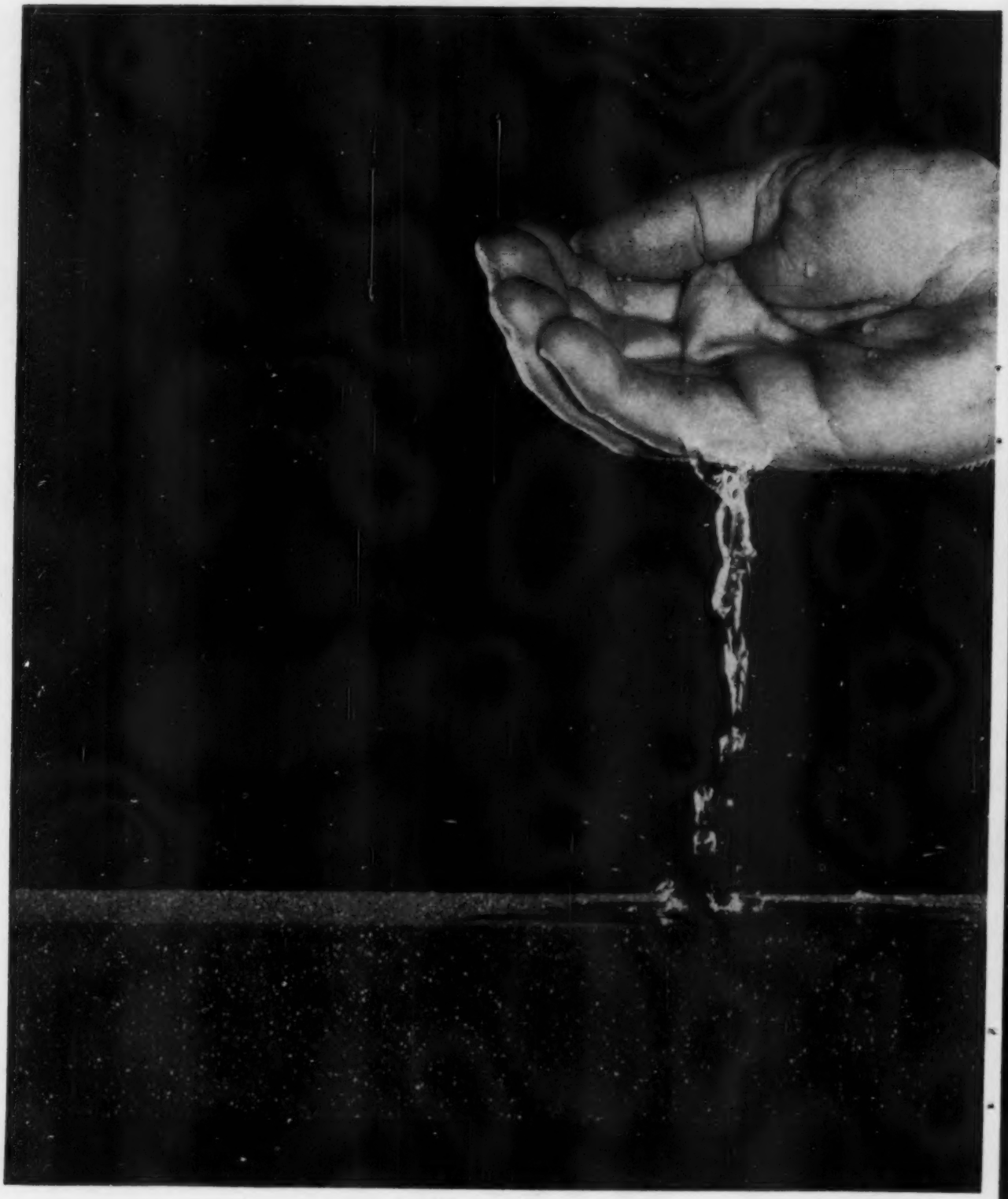

building material because it's **waterproof**
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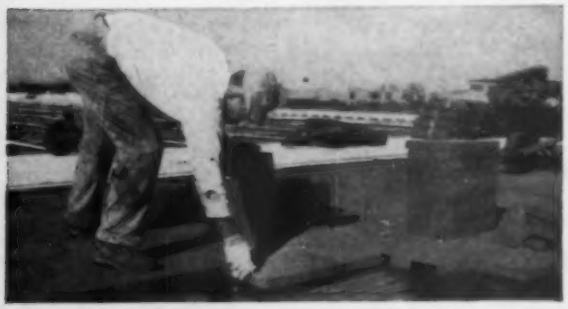
New FOAMGLAS-BOARD presents the quality of FOAMGLAS in an easy-to-handle new size, 2' x 4', for fast, economical, trouble-free roof installation. 1½" FOAMGLAS is sandwiched between specially laminated sheets of kraft paper, reducing the number of insulation joints.



FOAMGLAS insulation clears the air beneath this roof. Cold outside temperatures contrasting with a hot, humid interior atmosphere, had caused a fog-like condensation. FOAMGLAS roof insulation eliminated the problem. And the incombustibility of FOAMGLAS was an important extra-benefit here.

Stay-Dry Pipe Insulation guarantees constant insulating value because it stays completely impervious to water and atmospheric moisture. FOAMGLAS Stay-Dry Pipe Insulation maintains its thermal efficiency, supporting its own weight to prevent slump or sag regardless of how high vertical piping might run. And since FOAMGLAS eliminates condensation, hangers will never rust out.

◀ **The sealed glass cell** composition of FOAMGLAS makes it completely impervious to any form of moisture. On roofs, it remains dry even if the roof leaks.

See how these important FOAMGLAS **benefits** can work for you. Write for our Building Insulation Catalog. Pittsburgh Corning Corporation, Dept. PE-51, One Gateway Center, Pittsburgh 22, Pa. In Canada: 3333 Cavendish Blvd., Montreal, Quebec.

PITTSBURGH
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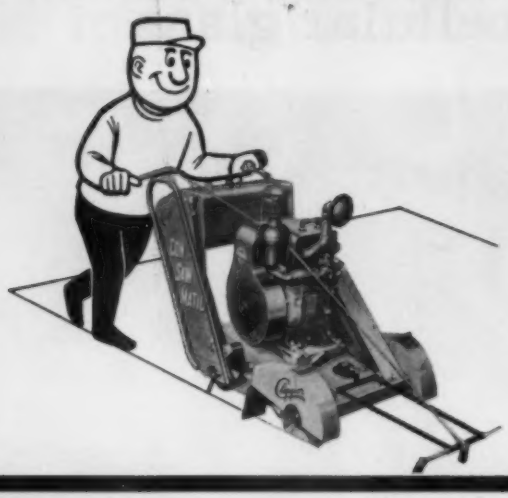

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LIKE THIS...

Note smooth, straight edges. Replacement material bonds better, patch lasts longer . . . water seepage eliminated. Sawed joint resists damage even under constant impact of steel wheel traffic.

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The weakened, feathered edges of this jagged patch job will chip and flake. Very possibly radial cracks far beyond repair area will present trouble here too. In all, it's a patch that won't last.

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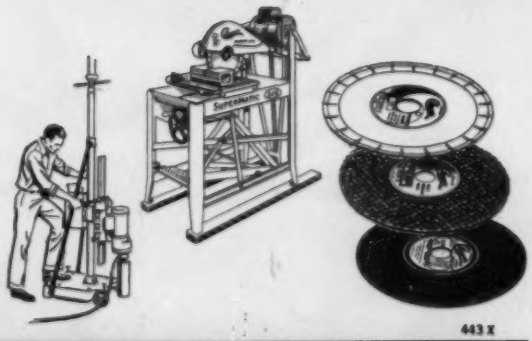
CLIPPER MASONRY SAWS cut every shape and size refractory and masonry material, wet or dry, in seconds—give you perfect reline jobs. Let a Clipper factory-trained representative show you in your plant why Clipper is the choice of 4 out of 5 Masonry Saw owners.

CLIPPER BLADES diamond and reinforced abrasive, for concrete and masonry saws. Can save you as much as 30%. Clipper blades saw more concrete and masonry materials than any other blades in the world.



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The conduit that beat 35 years of tough, atmospheric corrosion

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35 of Chicago's blistering summers. 35 of Chicago's blustering winters. Snow. Ice. Rain.

And only the labels were destroyed.

For 35 years this aluminum conduit has been protecting the cars' electrical system, located beneath the cars where they are subjected to most severe service conditions.

The aluminum conduit shrugged off atmospheric attack. Still on the job, it is delivering the same effective protection as the day it was installed.

Perhaps you can benefit from Alcoa aluminum conduit's corrosion resistance, lightness and strength in your plant. Contact your Rome-Alcoa representative, or write Rome Cable Division of Alcoa, Dept. 5-51, Rome, New York.

The Alcoa aluminum conduit beneath this Illinois Central car has been in operation since 1926—and only the color has changed.

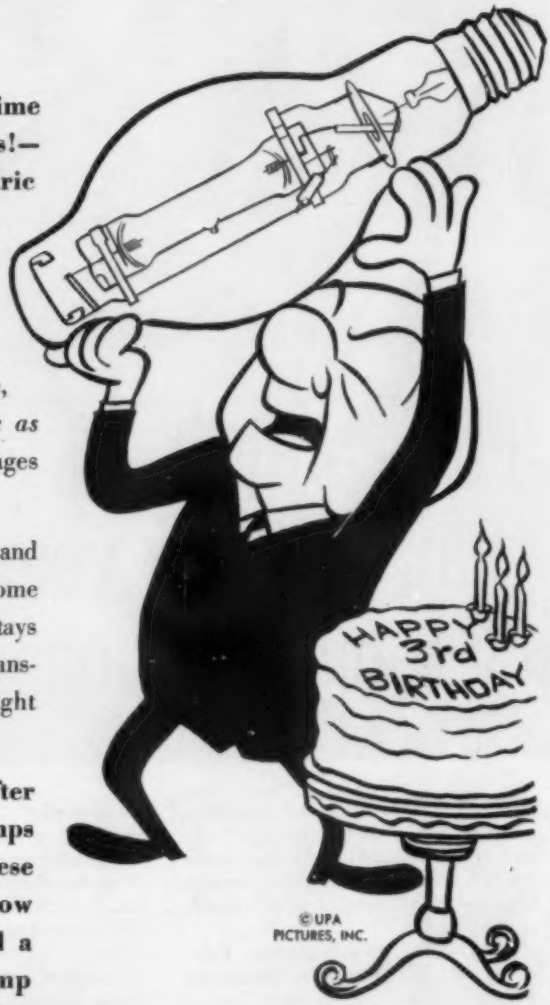
ALCOA
ROME CABLE
DIVISION

For more facts circle 564 on Reply Card

First from General Electric (1958)... another bright idea that became a better lamp for you... Bonus Line Mercury

works 6,000 hrs. overtime and cuts your costs

Nearsighted Mister Magoo says . . ."1958? How time flies! That's the year the Nautilus—gallant lads!—went under the North Pole, and General Electric developed the Bonus Line Mercury lamp. Happy birthday, Bonus Line. Egad, who built the ship in this bottle?"



Look again, Mister Magoo. It's General Electric's special new electrode. Up through the 400-watt size, it gives you 12,000 hours of useful life—*or twice as much as the old non-bonus line.* And the higher wattages (700 and 1000) give you 50% extra useful life.

Compare these two arc tubes, and you'll see where the extra hours come from. Notice how the new one stays white instead of blackening. The translucent *white* deposit lets more light come through.

Result: you get more light after 12,000 hours than ordinary lamps produce after 6,000 hours. These extra hours are free. And now manufacturing efficiencies and a growing demand for this lamp enable us to reduce its price 15%. Other popular G-E 400-watt mercury lamps are reduced 8-13%.

Important: All G-E mercury lamps are now made only in *heat resistant glass,* to prevent glass deterioration. Ask your G-E distributor for more details. General Electric Company, Large Lamp Dept. C-19, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more facts circle 565 on Reply Card

PRICE CUTTING— FACT OR FANCY?

Bitter complaints often are made by some manufacturers that price cutting by competitors has forced them into the defensive action of producing shoddier and shoddier goods in order to meet these prices. Obviously, there is some justification for these complaints. "Buying on price", particularly in periods of depressed industrial income and profits, is an old human custom. Sometimes such buying is a matter of survival; at other times it is a pinch-penny, shortsighted excuse for cutting initial costs—even if it means that the inferior products bought will prove far more expensive in the long run.

Nevertheless, under our economic system, even the manufacturers and purveyors of cheap merchandise have a right to exist—if they can. The maxim of *caveat emptor* still applies. Any consumer, be he an industrial plant engineer or a housewife, has no one but himself to blame if financial loss is suffered as a result of "price" purchases.

Now, let's flip the coin and look at the other side. There is a nagging doubt that every maker of "quality" goods has exerted his best and most intelligent efforts to effect efficient production and aggressive sales promotion. It is quite possible that some of the so-called price cutters are not price cutters in the classic sense.

It is a discernible fact that many manufacturers are more efficient, aggressive and imaginative than their competitors; they are better designers and managers and, consequently, are able to produce goods of equal or higher quality at lower price. Their channels of distribution are better established, their advertising more effective, and their service facilities more reliable. Generally, such an organization has earned, deserves and gets the lion's share of sales and profits.

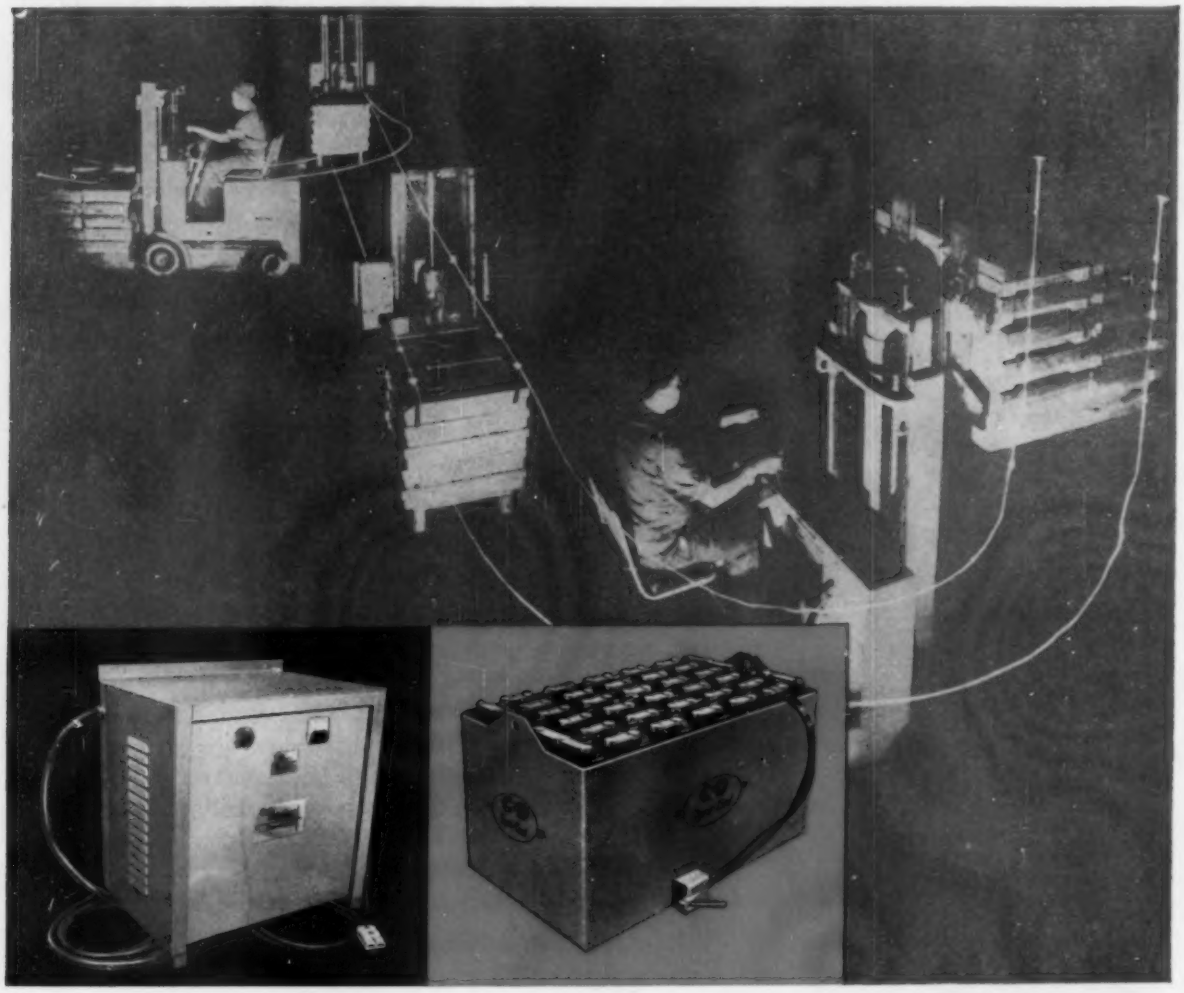
With these firms price cutting isn't "dirty pool". It's just a case of good business.

Tom Hanson

profit

When you power the best in trucks, electric—with the best in batteries—C & D *Slyver-Clad* you add profit to materials handling operations. ■ Electric trucks are clean and quiet. They don't contaminate the atmosphere and annoy personnel. User records prove under most conditions they cost less to own, run and maintain. ■ C & D *Slyver-Clad* batteries are the finest power package available for any electric truck because they provide extra long life plus dependable performance. Seven years of daily *full shift* operation are a common experience with C & D *Slyver-Clad* users. Many others report ten years of continuous duty. ■ C & D *Slyver-Clad* batteries are built for such performance. Quality *Slyver-Clad* construction throughout provides five separate layers of insulation and retentive materials to keep active materials in place. Life shortening, sediment build-up is virtually eliminated. Extra thick Accu-Pak® plates made under AccuRay Control** for greater uniformity and elimination of low cells. And finally, only C & D provides industrial truck battery users with *Hi-Impac* cell containers and covers that greatly reduce breakage of these elements. Trucks rarely have to be taken out of service to repair a battery. ■ These features, plus many more are why users report C & D *Slyver-Clad* is the battery that makes the difference. For specific application suggestions contact your nearest C & D salesman or write for Bulletin IT-530.

For Profit in materials handling! Use quiet, compact electric trucks powered with C & D *Slyver-Clad*® batteries—charged by *AutoReg*®!



C & D BATTERIES
of Conshohocken, Pa.
DIV. THE ELECTRIC AUTOLITE CO.

Manufacturers of Slyver-Clad® Industrial Batteries • PlastiCell® and PlastiCell® Batteries for Communications, Control, and Auxiliary Power • Producers of AutoReg® Silicon Chargers and AutoCell® Charger-Battery Combinations

For more facts circle 566 on Reply Card

WHAT'S JUST AHEAD IN THIS ISSUE

- WELL-REGIMENTED floor sweepers are giving their all at Convair. Through a careful selection of equipment, constant check of maintenance records and effective operator training, the company feels that they are getting maximum use from this equipment. For the full story, turn the page.

- INDUCTION MOTORS are called on to do most of the pushing, pulling, lifting and moving chores in industry. Starting on page 100, the design features of polyphase squirrel cage induction motors are discussed, tabular material points out applications for specific designs and eighteen guide points are listed for the selection of this equipment.

- LUBRICATION PROBLEMS? Multi-purpose greases may be the answer. To help you decide, the article starting on page 109 reviews the characteristics of calcium-base, sodium-base, mixed-base, and lithium-base greases. This background information should help you simplify your plant lubrication program.

- TALKING BACK to one's superiors—without getting fired—is an extra fringe benefit enjoyed by maintenance men at Waldorf Paper Products Company, thanks to a two-way radio setup. Now when a trouble call comes in, the foreman can analyze its seriousness, determine its priority, and dispatch his men. The men can, in turn, call back for additional help, parts or materials. To get the whole story, turn to page 112.

- OPERATION OF A mechanical drive is primarily dependent upon the characteristics of the load it is to drive. In the article starting on page 114, the correct approach to this problem, using applicable formulas, is presented by our author. If you're deciding on a drive motor, this material will be of value to you.

- FINISHED construction can only be as good as the specifications written for it. In 1958, PLANT ENGINEERING published a series of articles on the General Conditions under which a contract is written. Now, the author is writing the specifications for each of the building trades involved in a project. For the first of these helpful outlines, this one on earthwork, turn to page 118.

- PLANTWIDE cooperation in the use of special instruments and the know-how in their use is reverse "lend-lease" at Douglas Aircraft. Instruments cost money, lots of it; so maintenance, with some preplanning (except in emergency cases) can call on instrument specialists for their time, knowledge and equipment. For some specific examples read the article on page 121.

By Careful Selection . . .
Constant Maintenance Check . . .
Training Operators . . .
CONVAIR GETS MAXIMUM USE FROM ITS FLOOR SWEEPERS!

By **GUY N. NESBITT**, Supervisor of Sanitation, Convair, a Division of General Dynamics Corporation, Ft. Worth, Texas

The author reviews daily work assignments for his staff on this master map of the Ft. Worth plant. Paper tabs list key personnel.

One of the phones in Sanitation jangled sharply. It was a call from jet engine run Station 3.

"We've got a takeoff at 0900 from the north end runway," said the caller. "And we are moving planes into Stations 6 and 11 in about an hour."

"Okay," said the sanitation clerk. "We'll get a sweeper over there right away."

WITHIN MINUTES after our phone rings, warning that a B-58 jet will move out, one of our vacuum-ized sweepers goes into action.

At Convair this cleaning is an all important "special

assignment." No jet moves under its own power from our 177 acres of paved ramps and runways without this precautionary cleanup.

The technique is simple and swift. The assigned sweeper temporarily leaves its routine ramp sweeping job and heads for the jet cleanup area. On arrival, the sweeper (covering a 7⅓-ft path) begins a series of overlapping runs. A few minutes later, the machine has provided an immaculately swept lane for the waiting aircraft.

With its dust-shrouded vacuum-connected brooms the sweeper cleans a rectangular area. Size of the "safety area" varies. It may range from 150 to 200 ft wide, and from 500 ft to a mile long. But the object is the same: to assure 100 per cent dirt-free, debris-free surfaces where powerful "air-hungry" B-58's can operate safely and efficiently.

The sweeping operation I've just described is a routine one at Convair's mammoth 607 acre aircraft manufacturing installation.

It is part of a specially planned power sweeping program that saves well over $180,000 a year in maintenance alone. These are verified figures. We check and recheck our cost data—down to fractions of cents.

Even more important, however, is that our ultra-clean ramps are credited with helping us maintain an excellent safety record. Since starting this program, foreign object damage to aircraft tires, formerly a major problem, has been reduced almost to the vanishing point.

As in most plants with high maintenance and sanitation standards, our sweeping program has strong management support. This is important. It gives all of us a sort of unified "team" feeling; we are backed up in our planning, goals, and recommendations.

Three things are emphasized: (1) Round-the-clock alertness and efficiency, with well-planned programs. (2) Use of trained, experienced men on machines. (3) Constant diligent searching to discover new techniques or machines we can use.

Cost control is a must, too. "Do a better job at less cost" is our basic goal. To accomplish this, Sanitation keeps what may be the most complete maintenance records in the aircraft industry. With a company policy of expecting 10 years life from each machine, such records are absolutely essential.

Currently we have seven power sweepers. We have two Tennant Model 100 vacuumized sweepers for critical

Small sweepers are used for cleaning main aisles in the plant. Sweepers carry fire extinguisher for emergency use.

sweeping of jet operation areas, ramps, engine run stations, hangars, etc. These have fully enclosed brooms, each vacuum-enclosed, and special 540-sq ft dust filters. To give optimum dust control without resorting to hydrant stops—a disadvantage in extremely cold weather—these sweepers use no water. Air-cooled engines power the brooms, hydraulic system and vacuum system.

For sweeping truck traffic areas, equipment storage zones and similar non-operational paved areas we use a Wayne Model 450 sweeper. This is a large, exposed broom machine well adapted to handling heavy, bulky debris and truck traffic dirt.

For sweeping our interior plant aisles we use four Wilshire sweepers. These are confined to aisle work. Department cleaning is normally handled by the Sanitation Department. Sanitation may loan a department equipment on special occasions, but this equipment is returned at the end of a shift for inspection and storage.

Since mechanical sweeping is only a small part of Sanitation's responsibilities, we use only nine men (out of a staff of 154 employees) for operating the machines.

Convair uses extreme care in choosing sanitation equipment. Chief reason is our need for critical cleanliness, as manufacturers of jet aircraft. Second, our responsibility is continuous, round-the-clock. Third, our defense status and company policy call for rapid payoff of machine investments. We want every unit purchased to pay for itself—fast.

This policy has sometimes paid off with dramatic speed. For example, not long ago we spotted an unusual lawn-edging machine. We quickly estimated possible labor-savings and bought the device. It paid for itself in three days.

How do we go about selecting power sweepers?

First we determine our need. Where is the sweeper needed? When? What must the machine pick up? How critical, operationally, is the area? How big a space is involved and how long would it take to sweep manually? Is area congested? How high a priority do you place on this sweeping job in comparison with other assignments?

Finally the clincher: "Will this sweeper do X jobs as

Convair's cost-saving battery of sweepers includes two Tennants, four Wilshires and one Wayne. After careful study, company selected each of these sweepers for specific plant jobs.

FLOOR SWEEPERS

specified, work out better than other methods, and pay for itself not only initially but in routine program sweeping?"

Manufacturers often bring us the first news about newly-developed sweeping equipment. Yet there are exceptions. Frequently trade papers carry interesting new product releases before we are contacted directly. Advertisements too can be helpful.

But we prefer to get all the facts at one time, when we can. A good presentation will give us the complete picture. This means photos, bulletins, technical specifications, performance data. And if a sales representative brings the operating manual, parts list, and replacement schedule—so much the better. All these help us determine how complex the equipment is, ease of operation and servicing, and so on.

Other prime sources of information are aircraft plants, similar to ours. Correspondence with them or phone calls are very useful, particularly in appraising performance over several months' time.

Here manufacturers can do a helpful service by giving us good user-references on our first personal interview. I say "good" because stale, out-of-date references are worse than useless. We insist, too, on getting complete plant identification. This includes names and titles of all personnel, department locations, everything to speed up the job of bringing us facts in a hurry.

Informative Trade Shows

Trade shows, such as Plant Maintenance and Engineering, Institute of Sanitation Management, Materials Handling, Airport Operators Council—all these may also be good sources of information on new sweeping techniques.

Such shows are especially helpful if engineering personnel are on hand at the booths of manufacturers. A few minutes' chat plus some exploratory inspection of machines can be most useful. We like shows where booth attendants can give us facts, as well as answers to our questions.

What happens after we determine our need for a sweeper?

Next step is submission of data and estimate to our Industrial Engineering Section, and similarly to the A.M.C. and the U.S.A.F. Their job is to evaluate our recommendation in terms of two things: (1) cost and (2) performance. For the latter, demonstrations are usually required, witnessed by key officials.

Selection of Operators

So critical are some of the sweeping operations at our plant that we insist on carefully selected, well-trained men. It pays off. Your men are more alert. They like their jobs. They are more conscientious. And they get more service out of their machines.

Our sweeper operators like their assignments and stay with us. Some 60 per cent of them have been with us over 12 years.

Choosing a good operator is not easy when you have stiff requirements. We route an applicant through Personnel and interview him in Sanitation. He is then sent to the Education Department. Here he is subjected to a battery of tests, including IQ, mechanical aptitude, social adjustment, responsiveness, etc.

Medical tests are standard and are repeated every six months. But the tests also include special elements—such as visual perception at night, response-reflexes in emergencies, stability under stresses, reaction to jet-blast noise, etc.

Operator-training on a sweeper is comprehensive and

includes more than vehicle operation alone. We also insist on familiarity with company rules, plant regulations, speed restrictions and clearance requirements in sweeping around jet engines. What do you do in case of fire? What do you do in case of an accident?

Since we cannot afford needless downtime of our sweepers, we insist on constant inspection, lubrication and maintenance.

For example, take one of our vacuumized ramp sweepers. At the beginning of each shift the newly-arrived operator carefully goes over his machine. He fills out a "Vehicle Operator's Daily Report" on the spot. This includes 13 items. It covers everything from oil level, fuel, horn, lights and brakes to minor things like windshield wipers and fire extinguishers.

This works fine. It makes each operator personally responsible for his equipment every day. It keeps down any chance of buck-passing. And the report immediately flags any machine malfunction for correction at the earliest available time.

Ordinary maintenance is handled directly in our own department, but major mechanical work goes to the Traffic Department.

For example, we do all routine adjustments and minor repairs on our Wilshire sweepers. On our Tennant sweepers we change brushes (a 30-minute two-man job) check the hydraulic system, clean air filters, adjust skirting, and do daily maintenance greasing.

Our Traffic Department is responsible for garage-type repairs. This includes maintenance of engines, drives, steering mechanism, differential and transmission. Each maintenance or repair operation is minutely detailed and charged against the individual sweeper—each machine being identified by its own "CVAC Number" and "USA No."

With our detailed "life history" of each sweeper, plus carefully tabulated time-studies (covering each sanitation job), we are able to figure out our cost savings very accurately.

To show you the unusual detail of our time-estimates per task, here are a few random examples: A man handsweeps 1000 sq ft of smooth dry floors in 5.8 minutes in unobstructed areas; in 7.8 minutes in slightly obstructed areas; in 16.9 minutes in heavily obstructed areas.

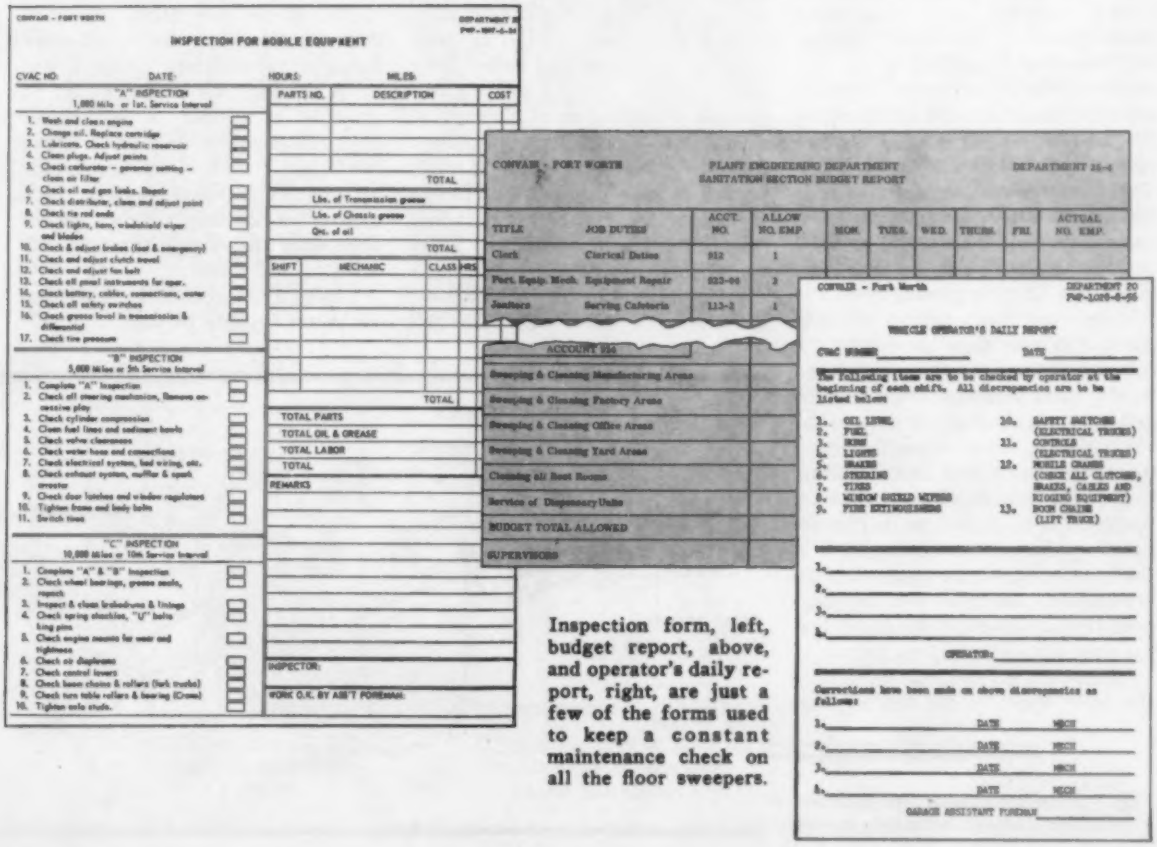
If the floor is rough, greasy and sprinkled with oil-sorb a man handsweeps unobstructed areas in 8.3 minutes. But it takes a whopping 24.8 minutes to sweep the same kind of floor if it is heavily obstructed.

Let's summarize our cost-savings with power sweepers.

Our four Wilshires, sweeping inside areas, cost $19, 542.00 per year including maintenance and wages. To do the same thing by hand would cost Convair $135,616.00. So here we save $116,074 a year.

To sweep outside (with two Tennant units for ramps and the Wayne for trucking areas) we pay a total of $17,480. If this area were swept by hand it would take 20 men to do the work of one sweeper, and it would cost us $84,040. So our savings in outside areas alone amounts to $66,560 a year.

Our total cost-savings then, through use of mechanical sweepers amounts to $182,634 yearly. **End**



INSPECTION FOR MOBILE EQUIPMENT

CVAC NO: DATE: HOURS: MILES:

"A" INSPECTION
1,000 Miles or 1st. Service Interval

1. Wash and clean engine
2. Change oil. Replace cartridge
3. Lubricate. Check hydraulic reservoir
4. Clean plugs. Adjust points.
5. Check carburetor - governor setting - clean air filter
6. Check oil and gas leaks. Repair
7. Check distributor, clean and adjust point
8. Check tie rod ends
9. Check lights, horn, windshield wiper and blades
10. Check & adjust brakes (foot & emergency)
11. Check and adjust clutch travel
12. Check and adjust fan belt
13. Check all panel instruments for oper.
14. Check battery, cables, connections, water
15. Check all safety switches
16. Check grease level in transmission & differential
17. Check tire pressure

"B" INSPECTION
5,000 Miles or 5th Service Interval

1. Complete "A" inspection
2. Check all steering mechanism, Remove excessive play
3. Check cylinder compression
4. Clean fuel lines and sediment bowls
5. Check valve clearances
6. Check water hose and connections
7. Check electrical system, lead wiring, etc.
8. Check exhaust system, muffler & spark arrester
9. Check door latches and window regulators
10. Tighten frame and body bolts
11. Switch tires

"C" INSPECTION
10,000 Miles or 10th Service Interval

1. Complete "A" & "B" inspection
2. Check wheel bearings, grease seals, repack
3. Inspect & clean brakedrums & linings
4. Check spring shackles, "U" bolts king pins
5. Check engine mounts for wear and tightness
6. Check air displacers
7. Check control levers
8. Check boom chains & rollers (fork trucks)
9. Check turn table rollers & bearing (Crane)
10. Tighten axle studs.

PARTS NO.	DESCRIPTION	COST
	TOTAL	
	Lbs. of Transmission grease	
	Lbs. of Chassis grease	
	Qts. of oil	
	TOTAL	

SHIFT	MECHANIC	CLASS	HRS
		TOTAL	

TOTAL PARTS
TOTAL OIL & GREASE
TOTAL LABOR
TOTAL

REMARKS

INSPECTOR:

WORK O.K. BY ASS'T FOREMAN:

CONVAIR - FORT WORTH — PLANT ENGINEERING DEPARTMENT — SANITATION SECTION BUDGET REPORT — DEPARTMENT 28-4

TITLE	JOB DUTIES	ACCT. NO.	ALLOW NO. EMP.	MON.	TUES.	WED.	THURS.	FRI.	ACTUAL NO. EMP.
Clerk	Clerical Duties	812	1						
Port. Equip. Mech.	Equipment Repair	823-04	2						
Janitors	Serving Cafeteria	113-2	1						

ACCOUNT 816

Sweeping & Cleaning Manufacturing Areas	
Sweeping & Cleaning Factory Areas	
Sweeping & Cleaning Office Areas	
Sweeping & Cleaning Yard Areas	
Cleaning all Rest Rooms	
Service of Dispensary Units	
BUDGET TOTAL ALLOWED	
SUPERVISORS	

CONVAIR - Fort Worth — DEPARTMENT 20 — FW-1026-6-56

VEHICLE OPERATOR'S DAILY REPORT

CVAC NUMBER_____ DATE_____

The following items are to be checked by operator at the beginning of each shift. All discrepancies are to be listed below

1. OIL LEVEL
2. FUEL
3. HORN
4. LIGHTS
5. BRAKES
6. STEERING
7. TIRES
8. WINDOW SHIELD WIPERS
9. FIRE EXTINGUISHERS
10. SAFETY SWITCHES (ELECTRICAL TRUCKS)
11. CONTROLS (ELECTRICAL TRUCKS)
12. MOBILE CRANES (CHECK ALL CLUTCHES, BRAKES, CABLES AND RIGGING EQUIPMENT)
13. BOOM CRANE (LIFT TRUCK)

1._____
2._____
3._____
4._____

OPERATOR:_____

Corrections have been made on above discrepancies as follows:

1._____ DATE_____ MECH_____
2._____ DATE_____ MECH_____
3._____ DATE_____ MECH_____
4._____ DATE_____ MECH_____

GARAGE ASSISTANT FOREMAN_____

Inspection form, left, budget report, above, and operator's daily report, right, are just a few of the forms used to keep a constant maintenance check on all the floor sweepers.

THE INDUCTION MOTOR— *WORKHORSE OF INDUSTRY*

By **S. F. HENDERSON**, Section Manager, and **R. F. WOLL**, A-C Motor Engineering, Westinghouse Electric Corporation, Buffalo, New York

INSTALLATIONS of three-phase, alternating current induction motors now average over eight horsepower per industrial worker. Because of the wide range of applications possible, it might be profitable to review fundamental factors that influence the performance of the induction motor.

An induction motor may be defined as an alternating current motor in which the primary winding, usually the stator, is connected to the power source and in which the secondary winding, usually the rotor, carries induced current. An exploded view of a drip-proof, three-phase motor of this type is shown in Fig. 1.

If these parts are assembled to form a complete motor and three phase power of the correct voltage and frequency is applied to the terminals of the wound stator, currents will flow in an amount necessary to provide the magnetizing force required to set up flux in the machine. The windings are arranged so that this flux rotates in the air gap at synchronous speed. This would be 1800 rpm for a four-pole winding energized with 60-cycle power.

When the rotor rotates at slow speed, the rotor bars are cut by the rotating flux and a voltage is induced in the rotor winding. This induced voltage causes current to flow in the rotor winding circuit consisting of the rotor bars and end or shortcircuiting rings. The flow of current creates a magnetic field similar to that established by the stator windings. It is the interaction of the magnetic field produced by the rotor with the magnetic field produced by the stator that provides force which turns rotor.

These rotors never run at exactly the same speed as the flux and the greater the mechanical torque required by the driven equipment, the greater the difference in the speed of the rotor and that of the flux. This difference in speed is called slip. When the rotor is at standstill the slip is 100 per cent and when the rotor is rotating at normal speed the slip is usually less than five per cent in most motors.

Since the majority of induction motors are of the squirrel cage rotor type and most industrial installations use polyphase power this review is purposely limited to the polyphase squirrel cage induction motor. The National Electrical Manufacturers Association has established design letters that classify these motors according to electrical characteristics. NEMA definitions, MG1-1.12 refer to tables for torque and locked rotor current values. Table I shows a generalized condensation of these characteristics and suggested applications.

While reviewing this table it might be well to keep in mind that Design B motors are capable of handling most industrial applications. These machines represent the volume production for the motor manufacturer and are tooled accordingly. This fact is reflected in price and to a lesser extent in delivery. It is to the user's advantage to employ Design B motors as universally as possible. Applications of other Design classifications should be limited to those installations where there is a real need for special characteristics.

Design A motors are the same basic type as Design B and are intended for the same kind of applications. Their performance characteristics are identical to the Design B machines, except that the restriction on locked current does not apply and the torques may be somewhat higher.

Because of their high starting torque, Design C motors are generally thought of as high torque motors. It should be recognized, however, that the pull-out or break-down torque of the standard Design C motor is less than the Design B. As an example, a number of compressor drive applications require a drive combining Design C starting torque with Design B pull-out torque. Such motors are available, but they are not necessarily the manufacturer's standard Design C motor.

Design F motors should be applied with care because of their very lim-

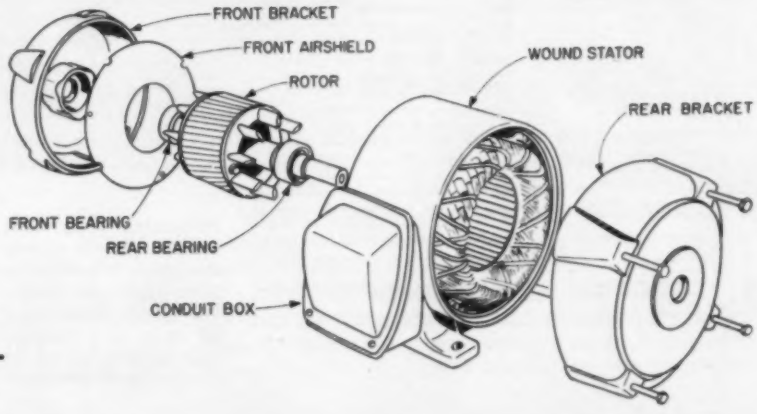


Fig. 1. Exploded view of standard alternating current induction motor.

ited torque capacity. It is recommended that the motor manufacturer participate in each Design F motor application.

Typical speed torque curves for the various Design letters are shown in Fig. 2. For more exact data on torque characteristics it is recommended that reference be made to the appropriate sections of the NEMA Handbook.

Voltage ratings standardized for polyphase induction motors are listed as 110, 208, 220, 440, 550, 2300, 4000, 4600, 6600 and 13,200. It is recognized that it is not practical to build motors of all horsepower ratings for all of the standard voltages.

208-Volt Motors

Considering the 220 and 440-volt ratings, which are widely used up to 100 hp, we know that the 220-volt ratings have been used on both 208 and 240-volt systems. Standards show the permissible variation from the rated voltage for induction motors as plus or minus 10 per cent and indicate that performance within these voltage variations may not be in accordance with the standards established for operation at rated voltage.

According to NEMA MG 1-4.22, a 220-v induction motor operated with 208 volts at the motor terminals will deliver approximately 11 per cent less locked-rotor and breakdown torque and draw from zero to four per cent more line current at rated load as compared to operation with exactly 220 volts at the terminals.

Network systems normally have less voltage variation than radial systems and are commonly held to about a minus five per cent variation. The usually accepted variation on radial systems is ten per cent. Hence, a 220-v motor which delivers sufficient locked-rotor and breakdown torque for successful operation on the minimum voltage of a 220-volt radial system will have essentially equal torque on the minimum voltage of a 208-volt network system. We can conclude therefore, 220-v induction motors can be and often are used on 208-v network systems.

Torques attained are adequate for blower and pump applications. The newer insulating materials used in present designs are suitable for operation at higher temperatures with no less life than the older materials. The somewhat higher current at 208 volts causes some increase in losses and temperature. What would otherwise be a loss in service life is offset by the ability of these newer materials to accommodate these higher temperatures with no reduction in life.

Operation of a 220-volt rated motor on a 240-volt system or a 440-volt rated motor on a 480-volt system poses no real problem. The performance characteristics will differ from those at rated voltage. While the full load efficiency may increase by about one per cent, the power factor may drop by three per cent and the current drawn from the power supply may drop about seven per cent below that of rated voltage.

Unbalanced voltages are of real concern for a small amount of unbalance may increase currents an excessive amount. The currents at normal operating speeds with unbalanced voltages will be greatly unbalanced and may be in the order of five to ten times the voltage unbalance. To avoid possible damage to the motor or depreciation in operating characteristics, the supplier of power should be notified of such unbalance in order that the situation can be corrected.

Standards show the permissible variation from rated frequency as five per cent. Performance within this frequency variation will not necessarily be in accordance with the standards established for operation at rated frequency.

According to these same standards, alternating current motors shall operate successfully at rated load with a combined variation in the voltage and frequency up to 10 per cent above or below the rated voltage and the rated frequency, provided that the frequency variation does not exceed five per cent. Again, performance within this combined variation will not necessarily be in accordance with the standards established for operation at rated voltage and rated frequency.

Operating Conditions

Polyphase squirrel cage induction motors are rugged machines and are capable of successful operation under many conditions. The general purpose, 40 C rated motors are designed to provide successful service at rated load under the following service conditions which are defined in NEMA MG 1-6.02 as usual:

1. An ambient temperature not exceeding 40 C
2. A variation in voltage of not more than 10 per cent from rated voltage
3. A variation in frequency of not more than five per cent from rated frequency
4. A combined variation in voltage and frequency of not more than 10 per cent from nameplate rating, provided the frequency variation does not exceed five per cent
5. An altitude not exceeding 3300 ft
6. Location or supplementary enclosures which do not seriously

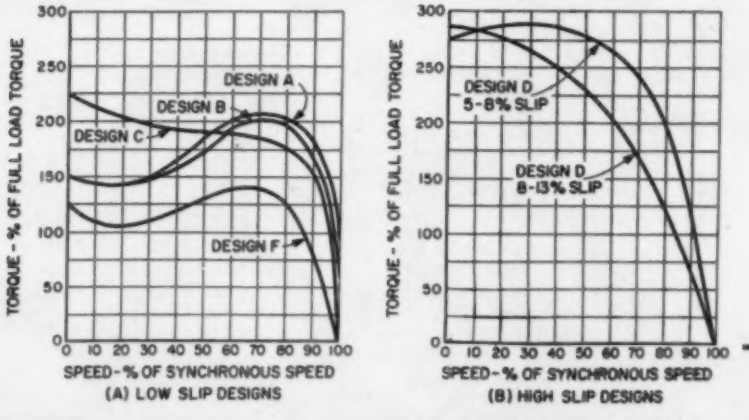


Fig. 2. Speed torque curves for four low slip and two high slip designs.

interfere with ventilation of the motor

7. Solid mounting and all belts, chains and gearing in accordance with adopted standards

Extreme care should be used in the proper selection of apparatus in order that successful operation and good service will result. Where the apparatus will be subjected to unusual risk, the manufacturer should be consulted.

Horsepower requirements of the driven machine can usually be determined from one or more of several methods. One of these is by testing the actual load on the machine, duplicating conditions under which it will normally operate. The watts can then be measured with an industrial analyzer or other instruments.

Another method relies on careful comparison. By comparing the machine to be driven with known power requirements of similar apparatus. This method should only be used when tests are not practical.

A third method uses accurate calculations. Factual information or power requirements for specific operations is used. An example might be the horsepower per cubic inch required at the tool to remove metal in a specified time.

Usual starting requirements of blowers and centrifugal type pumps do not represent a problem and the NEMA Design B motor characteristics are more than ample. One word of caution in connection with high inertia blowers. The efficiency of the rotor of an induction motor is equal to one minus the slip and the average efficiency in coming from rest to full speed is 50 per cent. Consequently, the loss in a rotor during such an acceleration is equal to the energy added to the driven system. With a high inertia blower, the kinetic energy added to the system may be appreciable and the loss in the rotor high. When in doubt advise manufacturer what the inertia is, speed of blower and the interval between starts. **End**

Table I. Electrical characteristics, load requirements and applications of NEMA design A, B, C, D, and F motors.

Motor Characteristics				Motor NEMA Design	Load Requirements Application	For such machines as:
Locked Torque	Pull-Out Torque	Locked Starting Current	Slip			
normal	high over 200% full load torque	normal	low less than 5%	A	For infrequent starts on moderately easy-to-start loads, requiring slightly more than full load starting torque. The motors relatively high pull-out torque will sustain occasional short duration peak loads. Regularly offered only in the larger totally enclosed fan-cooled ratings (40-200 hp). Other ratings can be built to order for special applications.	Compressors, started unloaded; conveyors, started unloaded; drill presses, fans and blowers, generators, grinders, lathes, machine tools, centrifugal pumps
normal	high 200% full load torque minimum	low	low less than 5%	B	Same as for design A except offered regularly in drip-proof enclosure 1-200 hp and totally enclosed, fan-cooled 30 hp and smaller.	Same as design A.
high 200% of full load torque	normal 190% full load torque minimum	low	slip less than 5%	C	For infrequent starts on hard-to-start loads requiring high starting (breakaway) torque. Not suitable for long accelerating times such as encountered in bringing high inertia loads up to speed. Limited capacity for peak loads.	Compressors, starting loaded; conveyors, starting loaded; electric stairways
high 275% of full load torque	. . .	low	high 5-8% slip or 8-13% slip	D	Continuous rated: for hard to start pulsating loads. Motor has no sharply defined breakdown torque point. Load peaks cause appreciable speed reduction which allows the inertia of driven machine to carry a part of the peak load, thus reducing current peaks in the line. Also reversing service. Intermittent rated: frequent starts with hard to start loads and short operating periods.	Press brakes punch presses tapping machines Cranes, elevators, hoists, valves and winches
low	extra low 135% of full load torque	extra low	low less than 5%	F	For easy to start loads where extra low locked rotor current is necessary and low torques are acceptable. Lack of torque margins restricts overload capacity and makes it imperative that the motor rating and the load be matched.	Applications are exceedingly limited. Refer to manufacturer before specifying.

A Plant Engineering AUTOMATION FEATURE

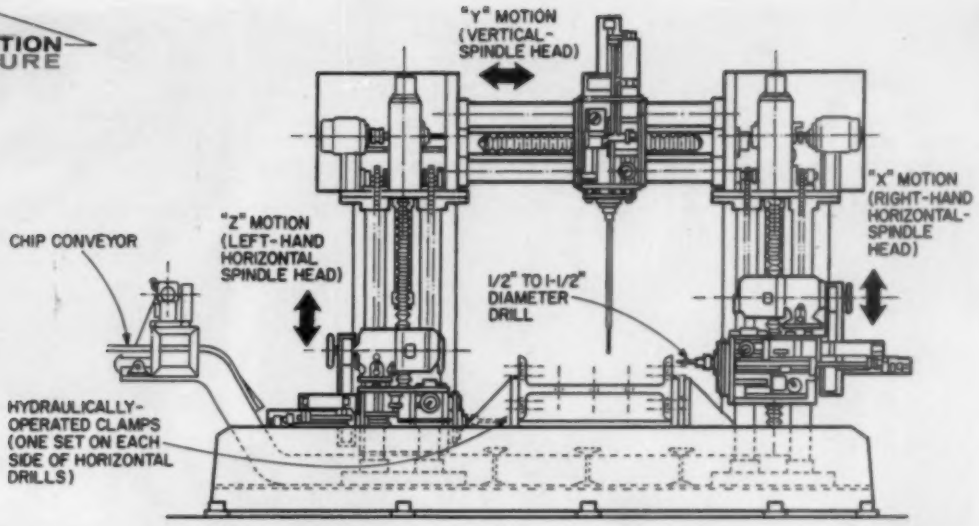

"Y" MOTION (VERTICAL-SPINDLE HEAD)
"X" MOTION (RIGHT-HAND HORIZONTAL-SPINDLE HEAD)
"Z" MOTION (LEFT-HAND HORIZONTAL SPINDLE HEAD)
CHIP CONVEYOR
1/2" TO 1-1/2" DIAMETER DRILL
HYDRAULICALLY-OPERATED CLAMPS (ONE SET ON EACH SIDE OF HORIZONTAL DRILLS)

Fig. 1. Three of the four positioning motions are in the directions of the arrows shown with the view of the machine. The other motion is along the work conveyor line.

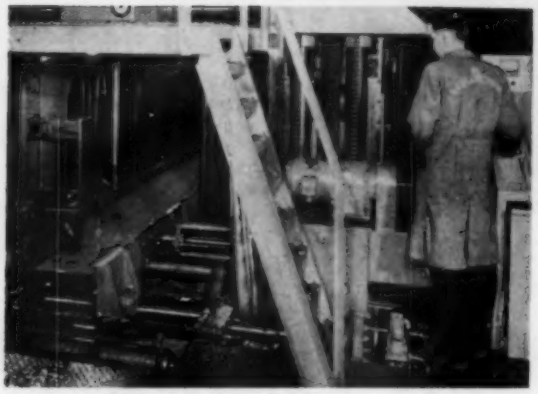


Fig. 2. Bridge member is clamped in a drilling position. Chains are part of the "X" motion spindle head drive.

NUMERICAL CONTROL FOR HIGH ACCURACY STEEL DRILLING

AT THE R. C. MAHON structural division plant in Detroit a large three-spindle drilling machine has been given the job of accurately producing holes in steel bridge members. This machine tool responds to signals effected by the perforations on paper tapes which are prepared at the plant. Commercial type data processing equipment has been adapted into a tape preparation system. While the operator feeds the information from a chart, hard copy of position and auxiliary data is prepared.

The resulting tape is installed in a tape reader within the machine operator's control console. Pushing of the cycle start button causes the tape reader to pick up the first block of information on the tape. Immediate movement to the command location or locations results.

Actually, three control methods can be used on the machine. In addition to tape control, the operator

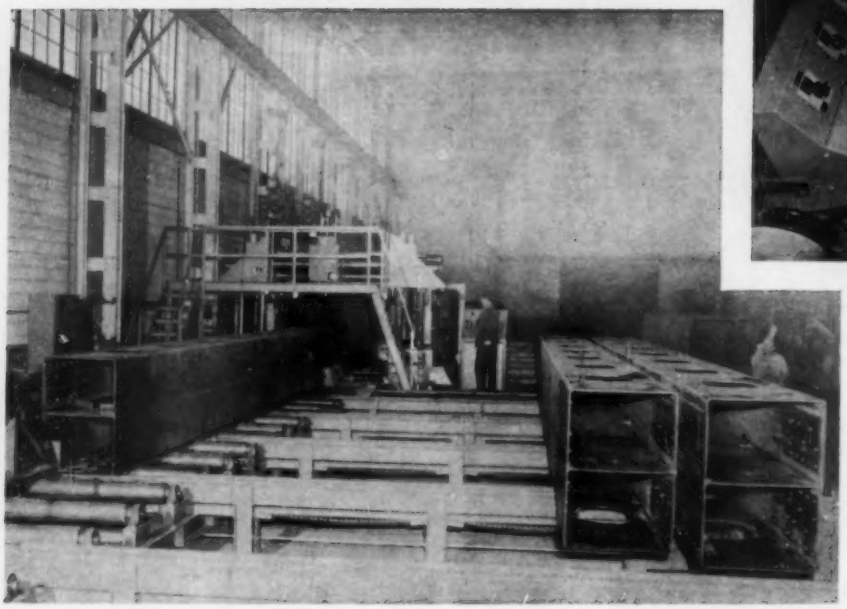


Fig. 3. Box bridge members on run-out conveyor ready for crane pickup. Portion of carriage arm is shown bearing against beam, at lower left. It is part of monitoring setup.

Fig. 4. The compact control console from which machine can be operated selectively by pushbutton, dial, and perforated tape.

NUMERICAL CONTROL FOR STEEL DRILLING

can resort to dial and manual controls. Dial control enables accurate positioning and drilling of holes that were not programmed on the tape. Manual control permits the operator to jog the drill in forward or reverse directions outside of the automatic drill cycle.

Movement of the beam over conveyor rolls is considered as the A-motion. Motions of the two horizontal spindle heads are identified by X and Z respectively. Y-motion designation has been assigned to the horizontal movement of the vertical spindle head. Auxiliary functions such as drill feed and retract are also in the automatic machine cycle that is initiated by the tape.

To check the position of a beam on the conveyor line, a contact arm on a specially designed carriage is made to bear against the end of the structural member in process. One of the rolls along the main conveyor line is equipped with two sprockets. One of these engages the chain of the main drive and the other sprocket engages a smaller pitch chain which travels over sprockets on the carriage.

One of the sprockets on the carriage is located on the shaft of a fluid coupling on the opposite side of which there is a 2-speed ½-hp motor. As the main rolls are being driven to move the beam, the tendency is to drive the carriage at the same speed. A light torque of the hydraulically-coupled motor acts in opposition to the forward driving force to hold the carriage against the beam and insure positive contact. Thus slippage of the beam on the conveyor rolls does not affect A-motion accuracy.

Mounted on this carriage is a selsyn unit which engages a long gear rack running along the side of the conveyor line. This unit is used for A-motion position feedback.

Drive Has Three Preset Speeds

The drive for the beam feed conveyor rolls has three preset speeds. A 600-ipm speed is provided for long distance travel between hole pattern. Short distance travel speed is 60 ipm and creep speed is 12 ipm.

Each drill head drive includes a hydraulic cylinder, ball bearing leadscrew, worm gear speed reducer, selsyn pickup unit and a ¾-hp, d-c positioning motor. The positioning motor is connected to the leadscrew through a worm gear setup. A selsyn unit is directly connected to the leadscrew for position feedback.

A hydraulic piston drive system on each drill head makes the job of the positioning motor relatively easy torquewise. When the motor is energized the leadscrew is released permitting the hydraulic cylinder to act on the movement of the spindle head. When the head is in the position indicated by the tape, the positioning motor is deenergized. The leadscrew becomes locked in position preventing further head motion. The hydraulic cylinder is pressurized while the leadscrew is stationary to avoid backlash in the system.

The new automated machine of Walter P. Hill, Inc. design, in its first application at the Detroit plant previously mentioned is cutting the cost of producing holes in drilled patterns by a high percentage over former layout, spacer-punching, reaming and radial drilling methods. Hole patterns are produced to such accuracy that reaming operations on structural members are virtually eliminated during assembly. **End**

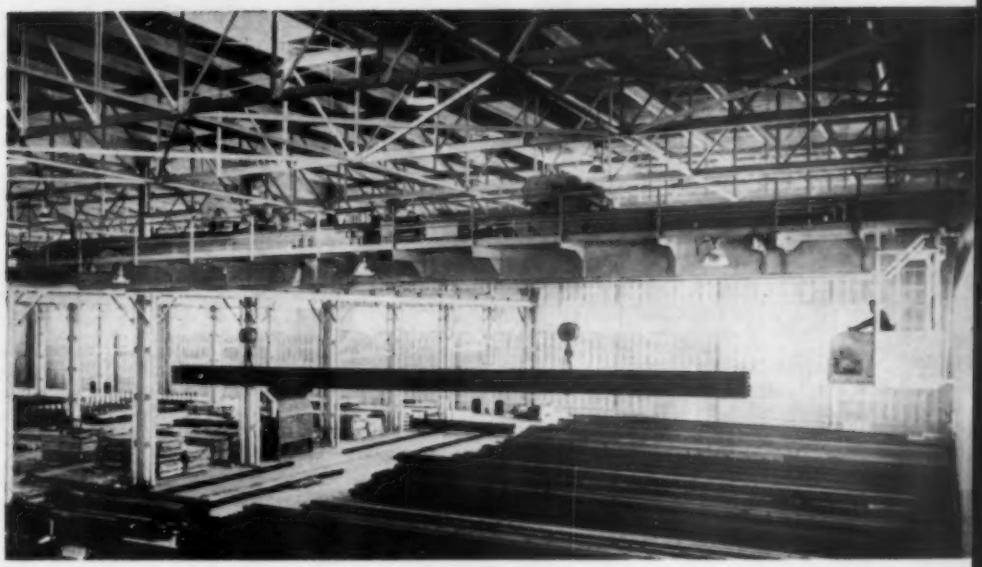


Fig. 1. Hydraulic crane has been in operation for two years in this plant.

HYDRAULIC CRANE— Designed to Reduce Maintenance

By W. A. MOREY, Vice President, Whiting Corporation, Harvey, Illinois

STUDYING overhead traveling crane users' problems disclosed that over one-half of crane service calls were electrical in nature and, of the remainder, a heavy majority related to brake troubles. While the investigation also disclosed some need for precision control, a more general and important requirement was the need for greater speed in order to improve crane utilization.

These general findings, plus one or two we added, provided the design objectives for a new hydraulic crane. Because these hydraulic cranes provide full stepless control of all motions with any load, they can be driven faster with complete safety and still handle loads gently. With the hydraulic drive system we also reduce electrical and brake maintenance as very little electrical equipment is used and the hydraulic system does most of the braking.

Several of these Hydro - Electric cranes have been in regular production use for periods up to two years. In a typical installation, two of these cranes are operating in a 500-ft bay in a large steel warehouse in Chicago. These warehouse cranes, Fig. 1, have bridge speeds of 400 fpm and each carries two 10-ton trolleys.

Hoists on these trolleys have a two-speed constant horsepower drive which is obtained by shifting the two hydraulic motors driving each hoist between series and parallel operation. Most of the lifts are five tons or less and in this range, hook speed is from less than six inches per minute to 100 fpm.

With heavier loads, the speed is halved and capacity doubled by pushing a button in the cab to shift a solenoid valve. If the operator misjudges the weight of the load there is no danger, because the relief valves in the hydraulic system will open to prevent lifting an overload.

Smooth stepless control of the crane shows up particularly well when handling long awkward lengths of steel. Cranes start and stop smoothly to keep the load from swinging and hoisting and lowering is accomplished without inching or jerking.

A quick examination of these cranes shows that electrical components have been reduced to a minimum and are simple in nature. The trolley uses a single unidirectional squirrel-cage motor to power all trolley motions. The bridge drive uses a similar motor. These two motors, plus their starters, a master switch and the lighting equipment represent all the necessary electrical equipment.

When a crane is working with reasonable regularity, the motors are allowed to run continuously. During normal operation the only moving electrical parts on the crane are the squirrel-cage electric motor rotors and three collector shoes. Since relief valves protect the motors from overloads and they are not subjected to frequent starting, stopping or reversing, it seems unlikely that motor burnout will occur.

Bridge brakes are of conventional foot - operated hydraulic design but are used less than is customary, as the bridge as well as the trolley is easily controlled by "plugging" or

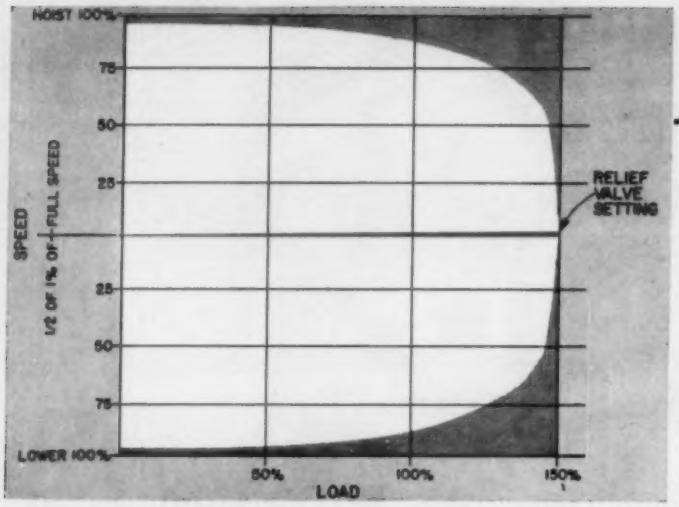


Fig. 2. Hoist speed-load curve shows 200 to 1 speed ratio. Control is fully effective with full load on hook. Overload drops ratio slightly.

HYDRAULIC CRANE

reversing the controls. Each hoist uses a mechanical brake applied to the hoist gear box pinion. This is applied by a spring and released by hydraulic pressure much in the same manner as the familiar solenoid brake. The spring stroke, however, is made sufficiently long to insure 150 per cent braking torque even after about one-third of the lining has worn away.

The hoist brake is not likely to wear very rapidly as it has little work to perform. The hydraulic system brings the load to a stop, the heat appearing in the oil rather than in the brake. Once the load is stopped, the mechanical brake sets, holding the load motionless.

Hoist speed - load curve, Fig. 2, while approximate, is conservative in showing an easily attained 200 to 1 speed ratio. Perhaps more important, the control is fully effective with a full load on the hook. When the crane is overloaded, the speed ratio drops somewhat but even under maximum overload an excellent degree of control is attained.

Operation of the hydraulic hoist system is illustrated in Fig. 3. A positive displacement pump (4), driven by electric motor (3), continuously drives a fixed volume of oil through pipe (6) which is connected both to the inlet port of a four-way directional valve (7) and to a sequence valve (9).

When the four-way valve is in the neutral position, its inlet port is blocked and all of the oil will therefore pass to the sequence valve. This valve has a plunger (10) normally biased toward a closed position by spring (11) arranged on the side of the valve opposite the valve exhaust port. The spring is quite light and the plunger is lifted by the oil from the pump at approximately 30 psi. This allows oil to escape through discharge pipe (12) to the cooler (20), filter (21) and back to the tank (5).

When lifting a load, Fig. 4, spool (13) of four-way valve (7) is moved downward, allowing oil to pass from the inlet port of the valve to pipe (14) across an orifice formed by movement of spool (13). Oil travels through check valve (17) and pipe (18) to the hydraulic motor (1) connected to the hoisting drum (2) through a suitable gear train.

The oil is still under a relatively low pressure (30 psi) and therefore, unable to drive the hydraulic motor to lift the load. However, note that

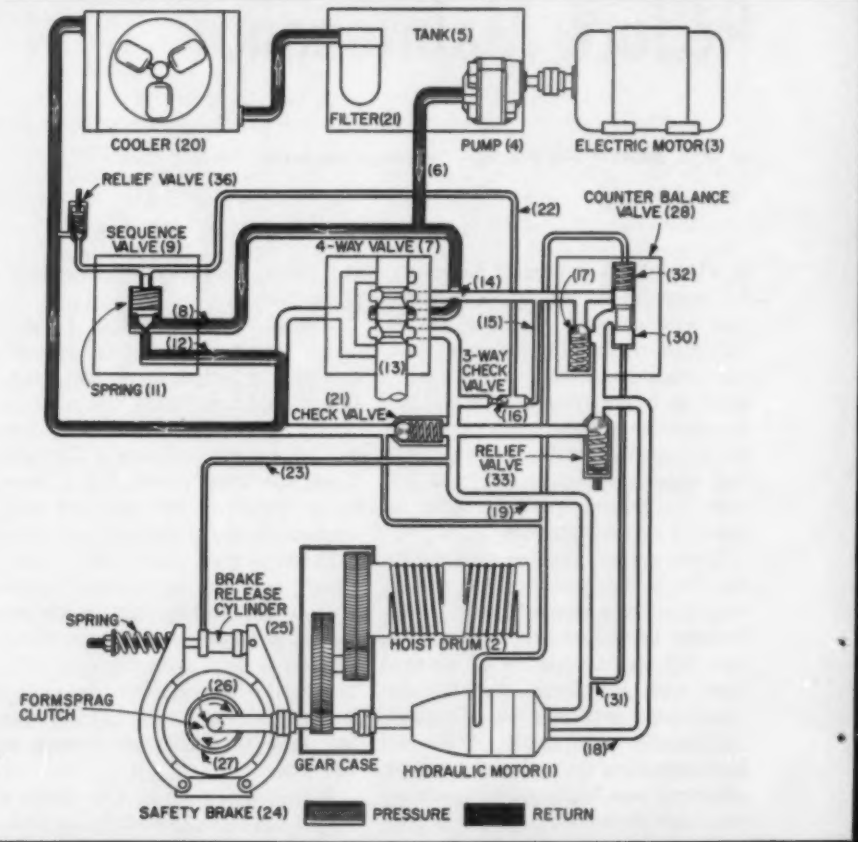


Fig. 3. Hydraulic flow with control lever in neutral. Oil moves to tank.

pipe (14) also is connected by pipe (15) to a shuttle valve (16) which, urged by the oil, moves to the left and allows oil to enter the sequence valve through line (22) to supplement the valve closing force of spring (11). This raises system pressure, in a fraction of a second, sufficiently to drive hydraulic motor (1) and lift the load. Oil passing through the motor returns to the four-way valve through pipe (19) and is discharged to the cooler (20).

This system will develop only enough pressure to safely obey the commands of the operator, and this is true from empty hook to maximum load conditions. In other words, hoisting speed for any given position of the operator's control handle is virtually constant under all load conditions.

Brake (24) is mounted on the pinion of the hoist gear box and remains closed under the pressure of the spring during the hoisting operation. Movement is permitted by mounting a sprag clutch on the pinion shaft. This is a one-way clutch which allows the hoist pinion to turn in the hoisting direction only. Thus, unless hydraulic pressure builds up sufficiently to lift the load, it will be held against lowering by the brake (24).

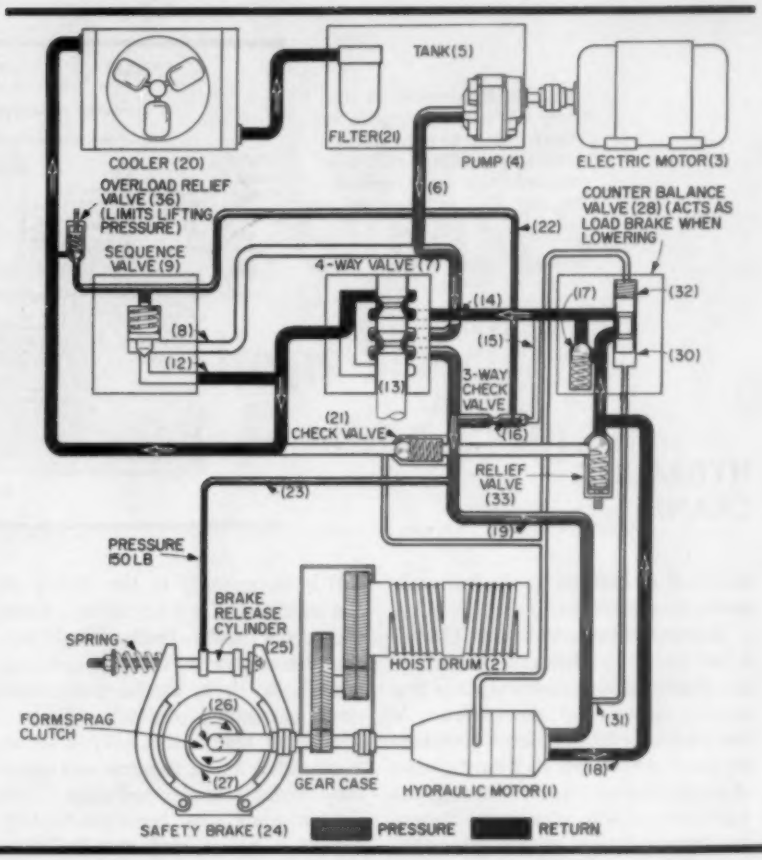


Fig. 4. Below: When hoisting, spool is moved down, oil flows to motor.

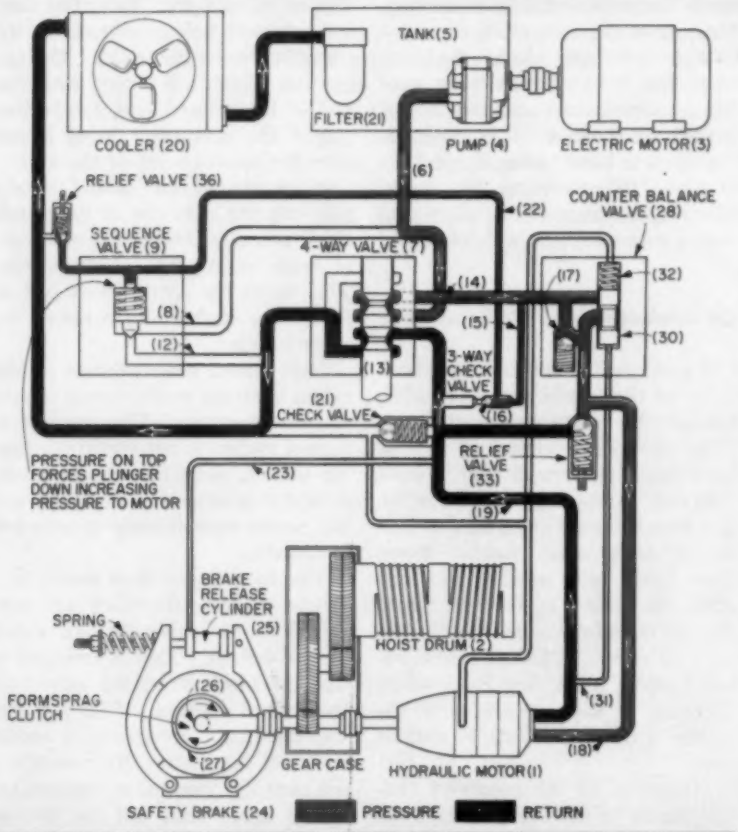


Fig. 5. Above: When lowering, spool is shifted upward, reversing oil flow.

To lower a load, Fig. 5, spool (13) is moved upwardly, forming an orifice between the pressure inlet port and pipe (19). By reversing the flow of oil, motor (1) will be driven in the opposite direction but cannot turn until brake (24) is released by actuation of the hydraulic cylinder (25). This will occur only when a predetermined pressure, say 150 lb, is developed or exceeded in pipe (19).

As the brake opens, oil flows through the motor into pipe (18) but is prevented from returning to the tank by check valve (17) and counterbalance valve (28). Balanced and biased to closed position by spring (23) this valve is moved towards the open position by pressure in pipe (19). As the counterbalance valve opens, it forms an orifice through

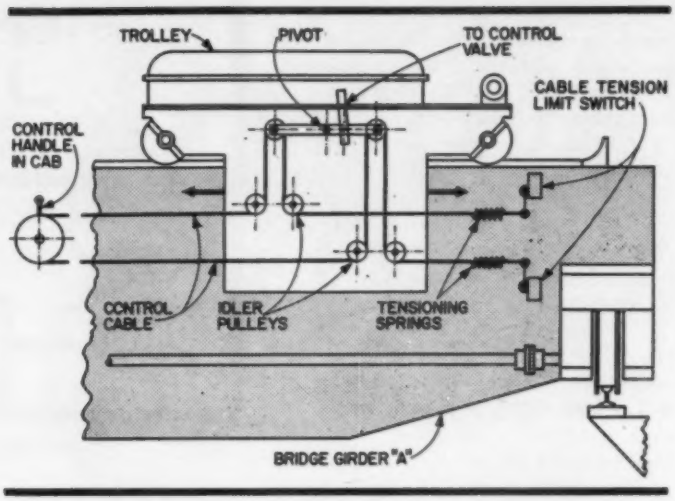


Fig. 6. Movement of operator's control handle is transmitted to appropriate valve on trolley with this closed-loop cable system.

HYDRAULIC CRANE

which oil discharged by the hydraulic motor is metered.

Pressure developed in line (18) is equal to the pressure developed by the load, which is driving the hydraulic motor, and the pressure in the inlet pipe (19). If the load tries to move downward at a rate greater than oil is being supplied through the four-way valve to pipe (19), the motor draws sufficient oil from pipe (19) to reduce the pressure.

This in turn, allows the counterbalance valve to move toward the closed position, thus throttling the rate of load movement. The counterbalance valve therefore is the load brake of this system. Oil discharged from the counterbalance valve passes through pipe (14) and through the four-way valve to the cooler. Note however, that if the four-way valve is moved to neutral position, this return flow through pipe (14) is blocked.

It is necessary to drive the hook downward with hydraulic pressure. If for any reason hydraulic pressure in line (19) should fail, the counterbalance valve will not open or if already open will close by action of spring (32) and block discharge of oil from the motor. Furthermore, if the four-way valve is moved to the neutral position, it will block discharge of oil through pipe (18). Loss of pressure in line (19) also causes brake (24) to set, retarding or stopping the load.

There are two relief valves in the system. One is located in the sequence valve communicating with pressure line (22). If the operator attempts to lift an overload, pressure will build up only to the setting of the relief valve but no higher. Thus this relief valve limits the lifting force developed by the crane and protects both the hydraulic system and the crane against overload.

Another relief valve (33) is set at a somewhat higher pressure and opens only under certain conditions. This occurs when the operator rapidly lowers a heavy load and suddenly moves the control handle to neutral. This causes the counterbalance valve to close and also blocks discharge from line (14). Under these conditions, severe shock could occur but instead, relief valve (33) opens, allowing oil to bleed through pipe (18) to pipe (19) absorbing the shock. In effect, this second relief valve provides a controlled rate of deceleration.

Oil Leakage

A great deal of attention has been given to the elimination of possible leakage. All valves are bolted directly to the ground surface of a large block manifold formed from a solid steel slab. All piping, with the exception of some small drain lines, is fabricated with heavy welded flange connections, held together with cap screws and sealed by O-rings. There are no threaded connections in the pressure system. This not only eliminates piping leaks, but also permits changing of any component in the system with simple tools in a short time.

Movement of the operator's control handle in the cab is transmitted to the appropriate valve on the trolley by a closed-loop cable system, Fig. 6. This cable is of the type utilized in operating aircraft control surfaces and runs along the crane girder from a tensioning spring, over a sheave attached to the control handle in the cab and back to a second tensioning spring.

The trolley supporting frame carries a bracket on which is mounted idler pulleys and a pivoted arm having sheaves on each end. From this arm, a mechanical linkage extends to the control valve on the trolley. The upper run of cable is looped over one end of the pivoted arm, the bottom run of the same cable being looped over the opposite end of the arm.

Movement of the control handle will lengthen one run of cable and simultaneously shorten the other run of cable exactly the same amount. This forces the arm to turn just so far but no further and positions the valve handle.

Held closed, limit switches on the cables interrupt motor current in case of cable breakage. This mechanical control system is not sensitive to cable tension, deflection of the girder or lateral movement of the trolley and has proven exceptionally trouble-free in operation.

The hoist upper limit device is a paddle engaging the block and connected to the valve through a lost motion linkage. This is arranged so that the block forces the valve into the neutral position. If for any reason the block overshoots, a switch shuts off the motor. This switch is not normally operated so frequent use of the upper limit will not damage the crane. **End**

MULTI-PURPOSE GREASES—

This Review Helps Simplify Your Plant Lubrication Program

By K. P. **POWERS**, Gulf Research & Development Company, Pittsburgh, Pa.

A FEW YEARS AGO the plant engineer, faced with an application requiring grease, was confronted with a bewildering variety of products from which to choose. It was the era of a special-formula grease for each application and it brought with it unwieldy inventories, excessive manufacturing and operating expense and, not infrequently, misapplication of the lubricants.

Today, the picture has changed. The manufacture and use of petroleum greases has been put on a more practical and economical basis by the development of multi-purpose greases. Suppliers and consumers alike benefit from the trend to fewer and better greases formulated for wider and more general application.

To earn a multi-purpose rating, a lubricating grease must do several things well —in contrast to the earlier calcium and sodium base greases which have individual strong points. Basically, a multi-purpose grease must have a high melting point and perform adequately at continuous temperatures averaging 250 F or more. It should have good water resistance and good-to-excellent resistance to breakdown and softening when worked. It should also resist separation or liquefaction after being subjected under working conditions to 250 F and then cooled.

The following review of the commonly used greases, both limited-purpose and multi-purpose, is intended to serve as a reference against which the plant engineer's grease lubrication program may be checked and possibly simplified.

Calcium-Base Greases

The most commonly used greases for general application are those with a calcium soap base. They usually consist of a mineral oil and a soap formed by the saponification of a hydrated lime and a suitable fat. The oil used may have a viscosity between 50 SUS at 100 F and 250 SUS at 210 F. The soap content ranges between 5 and 30 per cent; the hardness of the grease goes up as the soap content increases.

Most calcium-base greases have a smooth, buttery consistency which makes them suitable for high-pressure greasing systems. They are well suited for anti-friction bearings operating at moderate temperatures and speeds. They are particularly adaptable for bearings where water is encountered, because they resist its washing effect.

The first use of calcium-base greases was probably in compression cups, hence they are frequently referred to as cup greases. Calcium-base greases for compression cup application are ordinarily made with oils having viscosities of 100 to 600 SUS at 100 F.

The dropping points of cup greases are usually in the range of 200 to 225 F. Water, in quantities varying from 0.2 to 3 per cent, may be used to stabilize this grease, preventing separation of the soap and oil. However, if it is heated above the melting point and then cooled, it will separate.

Limitations of these cup greases

become evident when they are used in high-speed anti-friction bearings. They have low internal cohesion, poor stability at high temperatures, and good-to-fair resistance to softening upon working. If cup greases are held for prolonged periods at temperatures above 180 F, loss of water by evaporation may result in separation of the oil and soap.

Sodium-Base Greases

Sodium-base greases consist of an oil mixed with a soap formed by the saponification of caustic soda and fats or fatty acids. They have relatively high melting points. Having a tougher structure, these greases are generally more cohesive than the calcium-base types, particularly in high temperature operations. They may be fibrous or smooth in texture, depending on method of manufacture.

Because they are slightly soluble in water, sodium-base greases are not suitable for use where appreciable amounts of water may come in contact with them. On the other hand, since they do not require water to maintain an oil-soap equilibrium it is usually eliminated during manufacturing. Thus enabled to absorb small amounts of moisture, this type of grease prevents rust in many cases.

Many sodium-base greases show definite changes in structure, separation, consistency, etc., when heated above the melting point and then cooled. However, the better kinds show little or no change when used under these conditions. Their resistance to softening on working is also dependent on composition and processing conditions. They are widely used for plain and anti-friction bearings which operate at moderate-to-high temperatures and high speeds. Dropping points are in the range of 320 to 400 F and the superior types may be used at maximum continuous temperatures up to 250 F.

Mixed-Base Greases

Greases which contain two different types of soap are termed mixed-base greases. They have been developed in an attempt to combine in one grease the advantages of both types. One example is the sodium-calcium mixed-base grease. A typical grease of this type may contain three parts sodium soap and one part calcium soap. This grease has the same buttery consistency of a cup grease. It is practically water-free. It is moderately resistant to leaching by water, and has a melting point which approaches that of the sodium-base grease.

Block greases are specialized versions of sodium- and mixed-base greases. Hard to brittle in texture (they are packaged in brick form), they have dropping points in the range of 300 to 450 F and some types may be used at maximum continuous temperatures approaching their flow points. Generally, they show little change in characteristics when melted and subsequently cooled.

Block greases are susceptible to the effects of water and have fair to poor resistance to softening upon working. They are used primarily for open bearings and are applied directly against revolving journals. Large volumes of these greases were used, for example, in cement and paper mills.

As the need arose for greases that would perform well at higher speeds and temperatures, new classes of metallic soap bases—lithium, barium, and strontium, among others—were evolved.

Lithium-Base Greases

The most versatile of these are the lithium-base greases. They are resistant to the washing action of water and have dropping points in the range of 320 to 400 F. Their high-temperature characteristics are excellent and they show less change in structure after melting and subsequent cooling than do calcium- and sodium-base greases. With excellent resistance to softening on working, they may be used at maximum continuous elevated temperatures, as high as 250 F.

Lithium-base greases are usually smoother and buttery in texture and have good low-temperature torque and pumpability characteristics. As such, they are classed as multi-purposes greases—effective for use as general plant lubricants or as general-purpose lubricants in the automotive field.

Recently, the incorporation of special load-carrying additives with the lithium-base greases has increased their multi-purpose effectiveness—making them the recommendation in applications where bearings and gears are subjected to unusually heavy or shock loads. Lead soaps and various sulfurized oils are the most common additives employed to develop the extreme-pressure characteristics of these multi-purpose greases.

Calcium Complex Greases

Improvements in calcium complex greases—calcium soaps in combination with calcium salts (such as calcium acetate)—have enhanced their multi-purpose rating. Available for many years, these greases now have higher softening points, improved temperature stability, and inherent high load-carrying ability. They are not quite as stable mechanically as their lithium-base counterparts.

With the trend to the multi-pur-

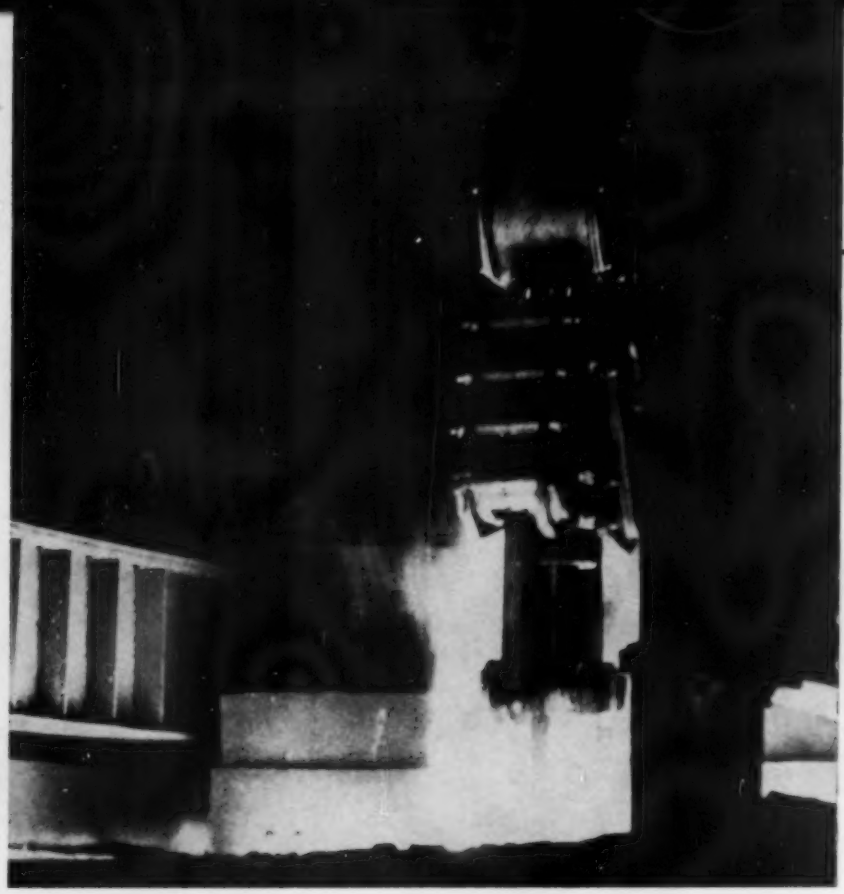


Fig. 1. Soaking pit scene at plant in which a specially formulated E. P. grease was used on bearings of shafts of eight pit covers. Bearing service life was increased by 60 per cent.

pose grease firmly established, today's grease research is aimed at extending the range of temperatures and speed at which such greases perform effectively. The need for such research is shown in the requests made to a typical petroleum company laboratory—the need of a grease by a textile mill operator to lubricate a new dryer operating at continuous temperatures of 350 F or more; or the requirement of a plastic manufacturer whose processing equipment feeds steam through the center of the bearing to reach the point of application.

Even more critical is the problem of the manufacturer of gas turbines who would like to be able to use a petroleum grease for lubrication. A suitable product would have to withstand temperatures of 600 F for 500 hr at 45,000 rpm. Research into these lubrication problems often shades into metallurgy—involving the very nature and composition of the bearing materials.

Among the factors now being studied in research aimed at extending the performance of multi-purpose greases are the fats or fatty acids from which the soap is made; the characteristics of the petroleum oil used; and the percentage of soap in the grease. Also being studied are chemical additives, and the effects of water, glycerin, and other materials that form an integral part of the original mixture. Finally, the techniques of grease manufacturing are known to have an important bearing on the effectiveness of the finished product.

Two developments in petroleum grease technology—as distinguished from the field of synthetic greases—show particular promise in meeting high speed and high temperature problems. The first is in the area of inorganic thickeners, formed of finely divided clay or silica-type materials. They are not soaps but have demonstrated many of the characteristics found in metallic soaps.

Inorganic Thickeners

The most interesting characteristic of the clay-base thickeners is that they do not melt. Where conventional greases liquefy or separate at certain temperatures, inorganic thickeners remain plastic until the grease oxidizes and is of no further value. Effective enough at the present time to earn a multi-purpose rating, the clay-base greases are still being improved in point of oxidation resistance, water resistance, and shear stability. Work is also being done on improving methods of mixing them with petroleum oils during manufacture.

Preformed Organic Thickeners

The second field of research involves preformed organic thickeners. These correspond to metallic soap bases, but in general, consist of organic or metal-organic compounds of more definite composition and structure than obtainable from natural fats. These compounds can be made with various molecular structures—minor modifications of which may effect a major change in a grease. Greases incorporating certain preformed organic thickeners are able to withstand continuous temperatures from 150 to 200 F higher than the best of present conventional multi-purpose greases. But they are expensive to make and this fact rules out widespread use at this time.

All-Purpose Grease

The ideal that is always somewhere ahead is the all-purpose grease, costing no more than the grease that does just one or two things well. Though the goal is being continually pushed ahead as new technological breakthroughs bring more stringent lubrication requirements, the improvements being made in multi-purpose greases keep the industry moving in the desired direction.

Meanwhile, the opportunities presented the plant engineer by these recent developments in grease technology are self-evident. In many cases a single multi-purpose lithium-base grease has replaced numerous combinations of limited and special purpose greases with savings in initial cost, reductions in wastage, and documented improvements in efficiency. **End**

Left: Floyd Dudrey, Pipe Fitting Foreman, goes into action with his two-way radio. Note the vest that was designed to carry the equipment.

Below: Frank Ellis, Electrician, receives message while standing beside the Cushman scooter. Ellis also carries a two-way radio set for use in getting parts without undue delay.

No Wait No Wander! TWO-WAY RADIO ELIMINATES INEFFICIENCIES

By **MILTON J. FRISCH**
Superintendent of Maintenance
Waldorf Paper Products Company
St. Paul, Minn.

ONE OF THE most troublesome roadblocks to efficient operation of any maintenance department is interdepartmental communications. This is particularly true in a plant like ours—a large, multi-story structure where six to eight different crafts may be employed on the same job.

Waldorf Paper Products Company, located in the center of a metropolitan area, is housed in a medium-sized plant covering approximately twenty acres. The plant is divided lengthwise by a city street. Vertically, the buildings range from a depth of 20 ft below grade to a height of five stories above grade.

Originally, our communication system consisted of a plantwide automatic code calling system covering shop offices and the maintenance storeroom, plus a paging system in the maintenance shops. Neither of these systems provided the fast, close contact between engineers, supervisors, foremen and craftsmen that was desirable. Too often, craftsmen out on a particular job were isolated from supervision when that supervision was most needed. This resulted in unnecessary leg work and consequently wasted time that might have been applied to productive work.

By the same token, the only communication between craftsmen on the same job, but who might be separated geographically, was leg work. Many man-hours were being lost in reporting for assignment between jobs. On-the-spot analysis of materials and labor was impossible. When production departments needed maintenance men for emergency repairs, during the periods when the dispatcher was off-duty, contact was, at best, difficult.

Becoming aware of the inefficiencies and wastes resulting from our old method of communication was half the battle. After a study of the problem and possible solutions it was decided to install a two-way radio system. Both sending and receiving units were to be carried by key personnel. Each craft foreman, each tour electrician, and each engineer was assigned a two-way radio. There were to be three base stations: one in the maintenance shop office, one in the electric shop, and one in the power plant for second and third

shift dispatching. The base stations required very little installation time.

The system was enthusiastically received by the foremen, partially because of the novelty but mainly because the suggestion had come from one of the foremen. Also, they were well aware of what a valuable tool the radio system could become.

As with all innovations, some personnel problems arose. But, as soon as the individual workmen saw the advantages in timesavings and reduced leg work they all welcomed the sets. The inconvenience of carrying the 2 lb 8 oz sets proved to be minor. Carrying the equipment in a wide leather belt proved an easy way of handling them. Recently, a sailcloth vest, with pockets, was designed and this, too, proved to be practical and popular. Both methods are good, depending on the job being done and the personal preference of the individual concerned.

Put into actual operation, the system has been used by each of the maintenance departments to good advantage in routine, preventive and emergency maintenance as well as in installation and construction work.

Electrical Department—Originator of the program, the electrical department was quick to fit out each of its tour electricians with a receiving set and to assign a transmitter to each gang box employed by the electricans. The electricians carry the receivers on belts but leave the transmitters on the gang boxes which are wheeled close to the area where they are working. When they receive a call they go to the transmitter and answer.

Equipped with Cushman scooters that are supplied with the necessary troubleshooting materials and supplies, the tour electricians have now become a fast, mobile emergency squad that can be rapidly and efficiently dispatched, coordinated with other crafts and linked with the engineering department.

Now the foreman knows the location of his men at all times. When a trouble call comes in he can analyze its seriousness, determine its priority and then dispatch the necessary electricians. The electricians can, in turn, call the foremen for materials or additional help as needed. The electricians can be called from another job —if conditions warrant—or be sent to the scene directly from the office. The foreman, able to visualize the entire work picture at the press of a button on his two-way set can act according to circumstances. Undiscovered troubles may be unearthed by the electricians while at work and serious damage prevented by their immediate report to the foremen. Difficulties not anticipated can be discussed with engineering.

Maintenance Service Department—The delivery of large parts and bulky lots of material to jobs is the responsibility of the maintenance service group. They provide rigging, blocking, staging; they clean up areas and perform salvage functions. The radios have simplified and streamlined their operations. Because they serve the entire plant their travel time was cut tremendously. Upon receiving a radioed request from a craft foreman for parts, materials or service the maintenance service department supervisor can quickly contact his men. In effect, use of the two-way radios have developed this department into a traveling storeroom.

Millwright Department—Our millwright department operates on the central shop plan. Two troubleshooting millwrights are assigned to shopwork that can be deferred at any time an emergency arises. When a trouble call or a high priority job comes to the office, the millwright foreman is called immediately. Depending upon the information given him he dispatches either his troubleshooters from the shop, or sends millwrights already working near the site of the trouble area to investigate further. If the troubleshooters are sent to the job they give an accurate report on conditions and report their needs for material and/or tools.

At first, the production departments were concerned because they didn't have millwrights on the job in their areas at all times. But, with the radio dispatching system the availability of a millwright actually improved, and at lower costs.

Steamfitter Department—Also working out of a central shop with one foreman, the steamfitters are dispatched to jobs by the foreman who carries sending and receiving sets.

Foreman to Foreman—The biggest bonus from our radio system has resulted from improved communications between foremen of different crafts. Designed to transmit and receive from set to set, or from set to base to set, the radios have made available supervision time formerly used in walking, looking, chasing parts or materials. The same advantages apply to the engineering department. We have now had our radios for long enough to find that they have filled the gap in our communications. **End**

Maintenance clerk and dispatcher, Dug Duren, talking with a foreman.

There Need Be No Guesswork When . . .

SELECTING MOTOR DRIVES

By R. G. MARSH, Allis-Chalmers Manufacturing Co., Norwood (Ohio) Works

IT IS IMPORTANT to know the mechanical characteristics of a driven load whenever one is selecting a motor drive for that load. Sometimes only one drive is the right one for a given application. Usually, drives have a limit on torque or acceleration while variable speed systems have additional problems such as speed range and speed regulation.

Once characteristics of the load are determined, a drive system can be quickly checked against them. In general, these characteristics are maximum and minimum torques required for running at various speeds and peak torques required at various speeds.

Maximum torques, together with the peak torques, will determine the size of the drive. Minimum torques are important factors in variable speed applications in determining the control or regulators required. Ideally, it is desirable to plot a curve of torque against speed for minimum and maximum conditions. However, many times this is not possible for either the machine has not been tested under all conditions or all the conditions are not known.

For instance, in the case of an extruder, compounds that are extruded today may not be the same as those that will be used two years from now. Usually several speed points are known and these, together with the general characteristics of the load, permit drawing a general speed-torque curve. In some cases where a larger machine is to be used, torque requirements can be projected.

Various types of loads can usually be described as constant torque, constant horsepower, or a combination of the two with a third category known as variable torque also entering the picture. This description together with the maximum load points, permits a fairly accurate plot of the torque-speed relations, Fig. 1. Loads which are mainly friction or tension are considered constant torque loads since the friction or tension requirements are essentially independent of speed. Examples of this type of load are surface winders, pull rolls, conveyors, presses, calendars, positive displacement pumps, hoists, and extruders. These types of loads are usually considered constant torque.

It should however, be pointed out that a given machine may be called upon to handle a variety of materials or conditions, and sometimes heavier torques are required only at low speeds. In this condition over-all machine requirements may result in a maximum torque curve that varies with speed even though for a given set of materials the torque does not vary with speed.

Constant horsepower loads are encountered in applications such as center driven winders and constant cutting speed lathes. In this type of load, torque decreases directly with an increase in speed, as with a center driven winder where constant tension is required.

In the case of the winder, as more material is wrapped on the spindle, the diameter increases and consequently bundle rotational speed decreases to maintain surface speed constant. At the same time, the lever arm or radius increases so that torque increases for a constant pull or tension on the material. Therefore, as speed decreases the torque increases.

These two relations can be summarized by referring to Fig. 2. Torque at the winder shaft is equal to tension times the radius and angular speed of the bundle is equal to the incoming linear speed divided by the circumference of the bundle.

Since the horsepower required is the product of torque and revolutions per minute times a constant, the radius of the bundle appears in the numerator and denominator so that the radius does not occur in the horsepower relation. Therefore, for a given tension and incoming speed, the input to the reel represents a constant horsepower input even though the speed and torque change.

Examples of variable torque loads are centrifugal pumps and fans. As speed increases in an operating pump, output of the pump increases faster than the increase in speed. As a result, torque increases as the speed increases, the rate being approximately that of the square of the speed. This means that the horsepower will increase approximately as the cube of the speed.

Generally the size or horsepower rating of the drive is based on continuous load requirements plus an allowance for load determination.

Most loads are not completely constant torque or constant horsepower, but do have a predominance of one basic characteristic or the other. On the basis of several known speed-torque points and a knowledge of the speed-torque relations, it is possible to fairly accurately size the drive. For example, assume a paper processing line nip roll drive or steel mill bridle drive which can be represented by a pair of rolls under pressure. Fig. 3.

These rolls are required to make up the tension difference in the strip and if Tension T_1 is greater than Tension T_2 this tension difference is $T_1 - T_2$. Therefore, the horsepower required at the roll shaft is

$$\frac{T_1 - T_2 \times \text{fpm}}{33{,}000}$$

Let us assume that Tension T_1 is

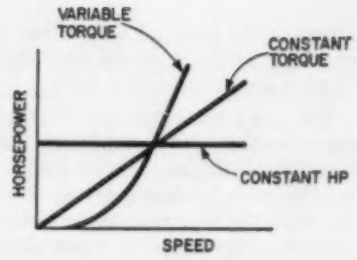


Fig.. 1. Typical torque-speed relationships for variable torque, constant torque and constant horsepower.

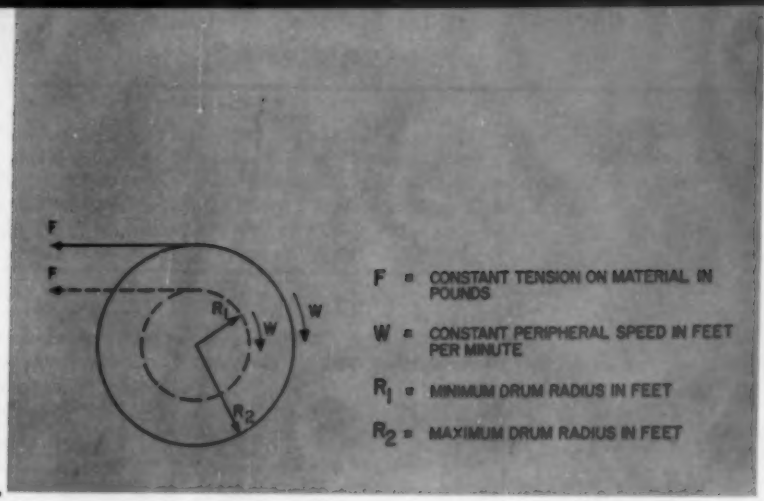


Fig. 2. As material is wrapped on spindle, diameter increases and speed decreases to hold surface speed.

1720 lb and Tension T_2 is 400 lb and that this requirement is known for 500 fpm line speed. The horsepower required is

$$Hp = \frac{(1720 - 400)\ 500}{33{,}000} = 20 \text{ hp}$$

Now assume that it is desired to increase mill line speed to 1000 fpm. Since tension requirements are the same, torque required by the rolls remains unchanged or constant torque characteristics are indicated. The horsepower requirements will increase directly with line speed thus the load would be 40 hp. This could be checked by calculating horsepower at the new speed assuming the same tension difference.

$$Hp = \frac{(1720 - 400)\ 1000}{33{,}000} = 40 \text{ hp}$$

Of course, this is only the horsepower required at the roll shaft as there are friction losses in the bearings. To size the drive, an efficiency can be assumed and requirements at the motor shaft determined assuming the tension difference of 1320 lb is the maximum required and that 1000 fpm is the top speed. With an assumed gear and bearing efficiency of 80 per cent, maximum horsepower required, neglecting acceleration considerations, would be

$$\frac{40}{0.80} \text{ or } 50 \text{ hp}$$

Inertia of the load and drive adds torque requirements to the drive, above that required to power the load at constant speeds. This inertia effect will be present not only in accelerating from zero speed but also during changes of speed in a variable speed system. Formula 4 in Table I gives the relation between torque, inertia, speed change and acceleration time.

From this it can be seen that if the other quantities are constant, the greater the inertia the higher the torque. The greater the speed change the higher the torque, and the smaller the acceleration time the higher the torque.

Inertia of the drive is extremely important, for in some drives acceleration torque may be greater than the torque necessary for constant running speed. In most cases the inertia is sufficient to affect drive performance to some degree.

There are two ways to check the acceleration requirements. First, if the machine requirements dictate an acceleration time, this, together with the combined inertias of the motor and load, is used to calculate the acceleration torque.

This is checked against drive capabilities and, if necessary, the drive is increased to take care of these acceleration torques. Next we must determine what excess torque is available for acceleration and then calculate the acceleration time to see if this time is acceptable.

As an example, a crane trolley has a large weight and small friction forces. Since acceleration times must be short for accurate positioning, the acceleration torque needed is much larger than the torque required for propelling. In this case, the drive is

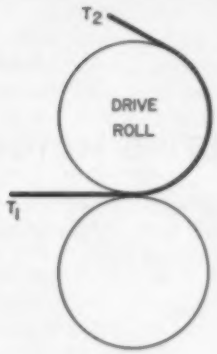


Fig. 3. Sizing motors on roll drives requires a knowledge of tension differences between rolls and speeds.

selected on the basis of acceleration torques.

In variable speed coordinated drives such as textile range drives, using d-c motors or magnetic couplings, it is important to match acceleration times of the individual drives during acceleration. Inertias of the various drives would be different so effort should be made to reduce acceleration torques as low as possible. To obtain this effect, acceleration time is made long and for the specific drive mentioned, a 45 second or longer acceleration time is used.

To calculate acceleration torques, it is convenient to refer inertias to one point and usually the motor shaft is the easiest. By adding motor inertia to the load inertia it is possible to calculate acceleration torque needed. Acceleration of a crane trolley is a good example.

Assume the trolley weighs 100,000 lb and travels at 400 fpm for full motor speed of 1170 rpm and a 100-

1. Accelerate in 4 seconds	150	lb ft torque
2. Run for 4 seconds	35	lb ft torque
3. Decelerate to zero in 1 second	300	lb ft torque
4. Accelerate in 4 seconds	150	lb ft torque
5. Run for 1 second	35	lb ft torque
6. Decelerate to zero in 1 second	300	lb ft torque
7. Rest for 12 seconds	zero	lb ft

This calculation can be made in tabular form as follows:

Operation	Time in Sec.	Torque lb ft	Torque squared seconds
1	4	150	90,000
2	4	35	4,900
3	1	300	90,000
4	4	150	90,000
5	1	35	1,225
6	1	300	90,000
7	12	0	
Total Time	27		366,125

Fig. 4. Sample calculation for determining horsepower requirements using the root-mean-square method.

SELECTING MOTOR DRIVES

hp motor with an inertia of 180 lb-ft² is used with a transmission efficiency of 80 per cent.

$$WK^2 \text{ of load} = \frac{100{,}000}{0.8} \frac{(400)^2}{(2\pi \times 1170)} = 370 \text{ lb-ft}^2$$

Assume transmission at 10 per cent motor inertia, therefore:

WK^2 of load	= 370
WK^2 of motor	= 180
WK^2 of transmission	= 18
TOTAL WK^2	= 568 lb-ft²

Torque required to accelerate the trolley from zero to full speed in two seconds can be found by Formula 4 of Table I.

$$\text{Acceleration torque} = \frac{568 \times 1170}{308 \times 2} = 1075 \text{ lb-ft}$$

Since the full load torque of this motor is 450 lb-ft, this acceleration torque is 240 per cent. This is high for most drives and because the motor must supply propelling torques it would be necessary to increase the size of the motor or increase acceleration time. If the 100-hp motor were used it would accelerate the trolley, but in a time longer than two seconds. Frequency of such operations introduces heating problems and leads into a discussion of duty cycles.

Purpose of duty cycle calculations is to select a drive for machines that have rapid operations that are cyclic or repeating. By breaking the operation into small components, calculating heating in these small intervals, and then averaging them over the whole cycle, it is possible to accurately determine drive suitability over this cycle.

There are quite a few approaches to this phase but most are based on calculating the ability of the drive to dissipate heat generated by drive losses. The calculations are quite analogous to filling a water tank intermittently. Losses on each portion of the cycle represent intermittent filling of the tank and the drainage represents heat dissipation of the drive.

Since most of the losses are electrical losses, they are proportional to the square of the current in the circuit. For simplicity, consider a d-c motor where the torque is generally proportional to the current. The losses then can be considered as being roughly proportional to the square of the drive torque.

In this case, the cycle would be broken down to acceleration, deceleration and running torques, and these components squared and multiplied by the time interval. The quantities would be added and divided by an equivalent time and the square root taken of this quantity. This would be the rms torque and could be compared with the rated torque of the drive.

This method should be used with caution, however, since the heating is not exactly proportional to the square of the torque. The equivalent time is a function of the heat dissipating capacity of the drive.

This equivalent time is only an approximation. An example of this type of calculation is shown in Fig. 4. This is a carriage traverse drive in which the torques have been calculated by previously described methods.

The drive motor incurs energy losses for 15 seconds of the duty cycle but achieves some cooling effect from the 12 seconds idle operation at the end of the cycle. Equivalent time is less than the total time, so without actually calculating it for this example, assume the equivalent time is 13 seconds.

$$\text{RMS Torque} = \frac{366{,}125}{13} = 168 \text{ lb-ft}$$

If motor speed is 1750 rpm,

$$\text{RMS hp} = \frac{168 \times 1750}{5250} = 56 \text{ hp}$$

The rms horsepower is then compared with rated horsepower and a 60-hp drive would probably be adequate. If the drive is operated for only a short period of time and then allowed to sit idle and cool for an hour or more before the next operation, size could probably be reduced.

Because the above method is not completely accurate, other means of

Fig. 5. A thorough engineering analysis of each of these four check points will insure successful drive.

1. Determine the mechanical characteristics and requirements of the machine;
2. Determine the size of the drive required, considering the mechanical characteristics and acceleration requirements;
3. Determine the speed regulation and speed range required; and
4. Check the power supply.

calculating duty cycles can be employed. One is the actual watt-seconds of energy transmitted in the given intervals, which takes into account the various heating and cooling factors of a given drive. It is best to give the drive manufacturer the mechanical data and let him use the method most suitable for the particular drive to allow an accurate drive selection.

Speed range is important both from the standpoint of sizing the drive and from the control standpoint. Most drives are limited in the speed range available. For example, most motors have some form of self ventilation so that their heat dissipating capacity decreases with a decrease in speed. Slip couplings, wound-rotor drives with secondary resistance, and constant potential d-c drives have increased losses as speed decreases. Therefore, the smaller the speed range, the greater the drive capacity for a given physical size. The speed range desired should be rather carefully determined.

Process requirements determine the speed range. For instance, an extruder drive may be required to produce a variety of shapes. The small cross section shapes would be run at a high speed while the largest cross section shapes would be run at a lower speed to maintain a constant lbs per hour output. The speed range required is determined by the size of the end product.

Similar considerations are encountered in other processes. Threading or jogging are usually not included in the speed range since they usually do not operate at these speeds for very long periods of time.

While the process may require a wide speed range it is not always necessary to have the range continuously variable. It may be possible to use a gear shift speed changer to provide two fixed ranges. Suppose a 20 to 1 speed range is required to go from 1750 to 87 rpm. By providing gears of 1 to 1 and 45 to 1, it is possible to cover the speed range with a 4.5 to 1 speed range on the drive; the 1 to 1 gearing could cover the speed range from 1750 to 390 rpm and the 45 to 1 ratio could cover the speed range from 390 to 87 rpm. In the case of a magnetic coupling, the use of a two-speed drive motor also would cut down the speed range requirements of the coupling.

As defined in Equation 9 of Table I, speed regulation of a drive is the no-load speed minus the full-load speed over the full-load speed and is usually expressed at full-load or base speed. In general, regulation at slow speed is greater than regulation at high speed. For instance, if a speed regulator has a speed regulation of one per cent as base speed, the regulation at $\frac{1}{10}$ speed is 10 per cent for the regulator.

Value of speed regulation required is determined by the driven machine. In many cases, quality of the product is changed by small speed changes. In this case good regulation is required to reduce the amount of adjustment. The normal d-c drive without a regulator will have a speed regulation of from five to 15 per cent. In some cases, such as a wound-rotor drive with secondary resistance, it may be 100 per cent.

While this natural regulation might seem unusable in many cases, the load torque is quite constant and the speed is adjusted each time by the operator. Under these conditions this natural regulation is usually not objectionable. In the cases of coordinated drives where the material is subject to considerable stretching and is pulled beyond the elastic limit, speed matching is the only way to obtain coordination. Since the quality or size of the product is affected by the exactness of the speed match and the loads change considerably, good speed regulation is essential and it is not uncommon to require speed regulation in the order of 0.25 per cent.

The power supply should be checked for capacity and compatibility with the drive system. In checking the capacity, the power system should first have sufficient capacity to supply the drive power and also provide this power without causing distress to other systems connected to this same source.

Acceleration and deceleration requirements should be checked against the power supply capabilities as well as the running requirements. For instance, if the lights in the plant dim every time the drive is accelerated or the drive becomes unstable when other equipment is energized, the power supply is not arranged for sufficient capacity. In some cases high pump-back powers caused by overhauling or regenerative loads are not compatible with the power supply. **End**

Table I. Useful formulas you will need to solve industrial drive problems.

1. HORSEPOWER & TORQUE

$$Hp = \frac{T \times rpm}{5250}$$

Where T = Torque in pound-feet
rpm = Speed of system in revolutions per minute
Hp = Horsepower developed

2. HORSEPOWER & FORCE

$$Hp = \frac{F \times fpm}{33,000}$$

Where F = Force in pounds
fpm = Linear speed in feet per minute
Hp = Mechanical hp developed

3. HORSEPOWER & WEIGHT (raised vertically)

$$Hp = \frac{W \times fpm}{33,000}$$

Where W = Weight in pounds
fpm = Speed in raising weight in feet per minute
Hp = Mechanical hp developed

4. ACCELERATING TORQUE

$$T = \frac{WK^2 \times rpm}{308 \times t}$$

Where T = Torque required to produce acceleration in pound-feet
WK^2 = Moment of inertia of rotating body in pound-ft squared
rpm = Speed change in revolutions per minute
t = time in seconds for speed change

5. HORIZONTAL MOTION

$$Hp = \frac{W \times F \times fpm}{33,000}$$

Where W = Weight of load moved in tons
F = Coefficient of friction in pounds per ton
fpm = Speed of movement in feet per minute
Hp = Horsepower required

6. MOTION UP AN INCLINE

$$Hp = \frac{\left[(\text{Wsin } \phi) + \frac{W}{2000} \cos \phi \times F \right] \times fpm}{33,000}$$

Where W = Weight of load moved in pounds
F = Coefficient of friction in pounds per ton
fpm = Speed of movement in feet per minute
ϕ = Angle between horizontal and slope up which weight is moved
Hp = Horsepower required

7. INERTIA OF LINEARLY MOVING WEIGHT

$$WK^2 = \left(\frac{W}{eff}\right) \times \left(\frac{fpm}{2\pi \times rpm}\right)^2$$

Where W = Weight in pounds moving at fpm speed
fpm = Linear speed of weight in feet per minute
rpm = Rotational speed in revolutions per minute
WK^2 = Rotational moment of inertia at speed rpm in pound-feet squared referred to the shaft at speed rpm
eff = Efficiency of the transmission drive

8. EQUIVALENT MOMENT OF INERTIA Through a Gear Change

$$\text{Equivalent } WK^2 = WK^2 \left(\frac{rpm}{rpm^2}\right)^2$$

Where WK^2 = Moment of inertia at output speed in pound-feet squared
rpm = Speed of output shaft in revolutions per minute
rpm^2 = Speed of input shaft in revolutions per minute

9. SPEED REGULATION

$$\text{Regulation in per cent} = \left(\frac{rpm_{nl} - rpm_{fl}}{rpm_{fl}}\right) \times 100$$

Where rpm_{nl} = No load speed in revolutions per minute
rpm_{fl} = Full load speed in revolutions per minute

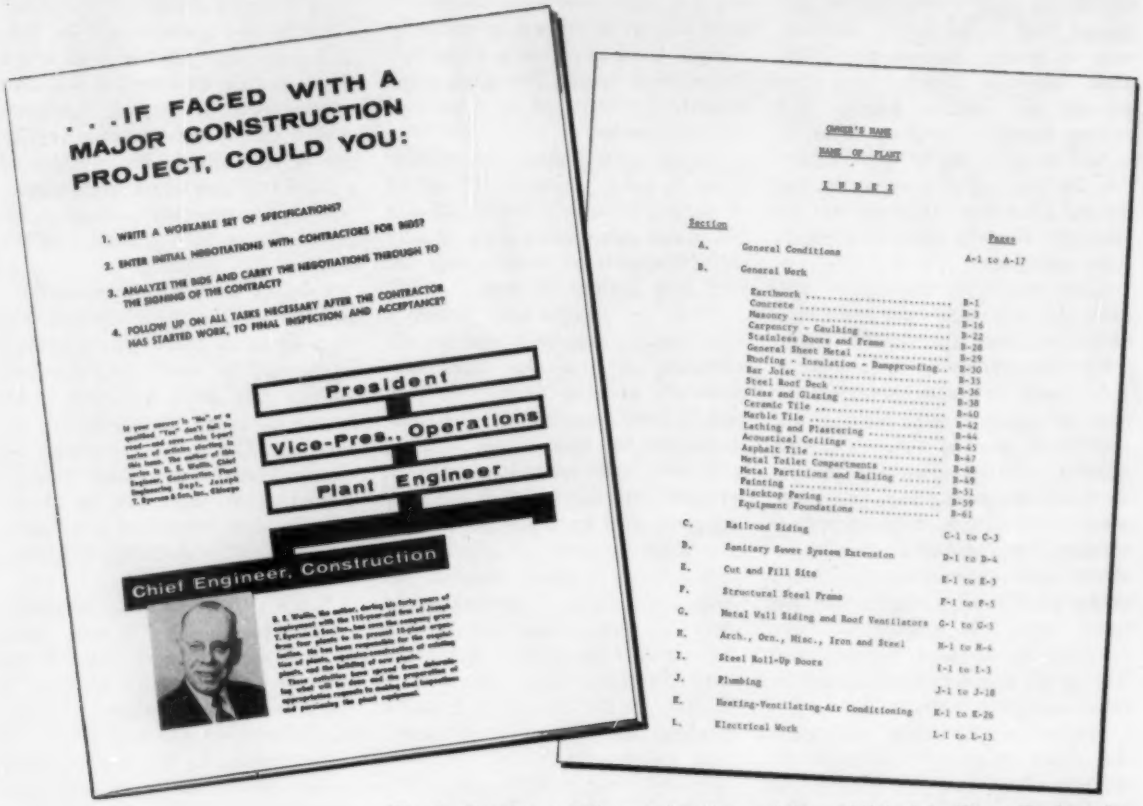

. . . IF FACED WITH A MAJOR CONSTRUCTION PROJECT, COULD YOU:
1. WRITE A WORKABLE SET OF SPECIFICATIONS?
2. ENTER INITIAL NEGOTIATIONS WITH CONTRACTORS FOR BIDS?
3. ANALYZE THE BIDS AND CARRY THE NEGOTIATIONS THROUGH TO THE SIGNING OF THE CONTRACT?
4. FOLLOW UP ON ALL TASKS NECESSARY AFTER THE CONTRACTOR HAS STARTED WORK, TO FINAL INSPECTION AND ACCEPTANCE?
President
Vice-Pres., Operations
Plant Engineer
Chief Engineer, Construction
OWNER'S NAME
NAME OF PLANT
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Fig. 1. Reprint at left contains five articles published in Plant Engineering by our author; index page at right list topics to be covered in current series.

CONSTRUCTION SPECIFICATIONS —for the Building Trades

By **R. E. WALLIN**, Chief Engineer, Construction, Plant Engineering Dept., Joseph T. Ryerson & Son, Inc.

DURING the latter part of 1958, PLANT ENGINEERING published a series of articles that discussed "General Conditions," Section "A" of a typical set of building construction specifications. These articles also covered taking bids, letting contracts, and the other construction activities.

Included in the 1958 series was a copy of a typical "index" for a complete set of specifications (see Fig. 1). However, in the 1958 series there was no discussion of the trades activities, sections "B" through "L" of this index.

In response to inquiries from readers for more information on the trades sections of a typical set of building construction specifications, the author is continuing with another series of articles. In this new series, the activities with reference to constructing a building, from the vacant ground site to the completion of the mechanical trades will be discussed.

It must be understood that no two construction jobs are identical; they can be similar, but everything said about one will not necessarily cover the other in full detail. Specifications must combine with plans to cover specifically what the owner wants in his building.

Your Construction Responsibility

YOU, as owner, as owner's representative, or as plant engineer, are going to become responsible for a construction project. Your activities in connection therewith will be easier if you know a little more about the

problems of architects and engineers, and what they will cover in their construction specifications to give you the building you want.

You have determined the type, dimensions, and general details of your building project. Your preliminary plans are well along, and you have discussed them at length in your various conferences with your technical counsel and your own organization.

You have reviewed and settled with the architects, engineers, and lawyers what will be included in the general and special conditions sections of the specifications, how bids will be taken, how contracts will be let, how you will supervise the actual construction, and other preliminary matters.

You have reached the point where the details of construction will be developed by the architects and engineers and included in the plans. As these details on the plans progress, the technical staff will make notes of various things which must be covered in the trades sections of the specifications, and the writing of trades specifications is started.

There will be questions and recommendations referred to you, and there will be many conferences. You will get along a great deal better if you have some knowledge of what is involved. Your position will be strengthened if your questions and check points reflect knowledge in each trade section of the specifications. In this series of articles we will try to highlight and to briefly discuss the trades sections of a typical set of specifications.

What do architects and engineers need before they can start preparing plans and specifications?

First, they should have a metes and bounds land survey which not only gives them all lot line dimensions and courses, but, also, complete information on above surface and below surface utility lines (water, sanitary sewers, storm sewers, gas, telephone, electrical, railroad, curb-gutter and streets, driveways, easements, etc.).

Second, they should have a topographical survey which gives elevations of the property along lot lines and on 25-ft or 50-ft checkerboard points (closer, if contour changes steeply or radically). Elevations of subterranean pipelines should also be shown on either the land survey or on a separate topographical survey.

The foregoing information is provided by licensed civil engineers who have geodetic bench marks to work from and who have access to governmental records. Therefore, when they certify to the survey, their data are accepted as being correct. With this information available, the architects can locate the building on the site at correct levels for egress and ingress, provide for utility connections, plan good landscaping, and generally fit the building into the neighborhood.

Third, they should know about subterranean soil conditions. Such information is provided by engineering companies that specialize in making soil test borings. During the progress of boring, the engineers accumulate complete data, and their boring logs and final report give the building design engineers information from which they can design adequate foundations.

Fourth, the design engineers must be thoroughly familiar with governmental zoning, building, and public health and safety codes which may apply to the building.

Lack of complete and reliable information to permit correct design and development of the construction can eventually become expensive. It is better to be complete and right to start with than to find errors when work is under way.

Content of Trade Specifications

GENERALLY, trade specifications are divided into sections, and how this is done will vary from job to job. In this series of articles, various trades and areas of work will be covered by lettered section headings and by division headings under the lettered sections in a manner which will carry through from "earthwork" under "general work" to the finishing trades ending with "electrical." (See Fig. 1)

Each section of the trade specifications should point out that all work therein is subject to the applicable provisions of the general and special conditions sections (covered in 1958 series) of the specifications.

Each section should also have a heading "Scope," which should point out the following points:

(a) That the contractor shall provide all labor, materials, equipment, supplies, tools, and services required to complete its specific outlined work as covered by plans and specifications or as intended in the same to complete the job.

(b) That the contractor should sublet any work not normally performed by it.

(c) That the contractor shall secure all permits and pay for same as part of its contract.

(d) That shop drawings, as required are to be made by the contractor and are to be submitted and approved before commencement of any work.

(e) That if plans were not followed, a set of plans should be marked "as built" and turned in to the architects so they can revise the plan tracings in their permanent files.

A. GENERAL CONDITIONS

(This section published in PLANT ENGINEERING, Aug.-Dec. 1958; available with five-article reprint, for $2.00, from the Editor, PLANT ENGINEERING.)

B. GENERAL WORK

EARTHWORK

CUT AND FILL. If the site is large and irregular, having high and low spots, then the architect will develop cut and fill profiles which will enable him to determine the approximate number of cubic yards of dirt which must be cut from the high spots and how much must be filled into the low spots to give suitable levels. The result may be excess material to be hauled away or inadequate material, which means providing fill. What comes out of excavations for the basement area and foundations must be considered in these computations.

If there are trees and vegetation on the site, what should be done to move or remove such plantings must be outlined. Such materials should never be buried under construction.

If fertile top soil is to be saved for future use, where it is to be piled should be outlined.

EXCAVATING. The specifications will vary with conditions of the site, type of foundations, and soil conditions.

(Please turn page)

Fig. 2, 3. Belled bottom caisson type foundations are drilled with the equipment shown in top picture; mechanical tamper improves tamping operation in small areas.

CONSTRUCTION SPECIFICATIONS

It may be necessary to drive piles; drilled piers with enlarged bottoms resting on hard pan may be needed; spread footings to specified depths may be called for; large reinforced slabs laid just below the surface may be best; or a checkerboard of reinforced grade beams may be indicated. Any one or a combination of these methods may be specified or may develop as work progresses. We will cite a few interesting experiences.

One job in Philadelphia is known where some of the column piers were set on spread footings, other piers were set on caps over nests of piles driven into 10 to 35 ft of cinders and low bearing value soil; still other piers were set on mica shist which was cut and leveled with jack hammers.

On a large project in Milwaukee, short piles were needed in one corner area, rock had to be cut out to level surface in another corner area, and spread footings on gravelly clay were laid in the other two diagonal corner areas.

Along the Mississippi River in St. Louis, river bottom gumbo was found under four to six feet of cinder fill. On the engineer's recommendations, excavations were made to within one foot of the bottom of this fill, and 4-in. x 4-in. x 7-ft-long creosoted pin piles were driven through the foot of fill into the gumbo, over which spread footings were laid. Skin friction of the 80 to 100 such piles under each column alone developed the theoretical bearing value required to carry the various column loads without giving any value to the piles.

In Chicago, so-called drilled caissons, up to 100 ft or more in depth into hard pan, meeting a specified penetrometer test, are becoming more and more popular. Excavated caissons down to bed rock have been used here for many years under skyscrapers..

In Jersey City, the ground water level was at the ground line, at a site close to the Hackensack River, and this water level had to be lowered before sand on the site could be excavated. Well points were driven at regular intervals around the perimeter. These were connected to large header pipes which were emptied by diesel-driven pumps; the pumps operated around the clock to lower the water level below the bottom of excavations. The sand was excavated to smooth bottoms with cut sides, and spread footings were poured without forming. When all pads were in place, the well points were pulled, and the piping and the pumps were moved off the site. This was more economial than to drive sheet piling and pump water out of the excavations.

From the above, it can be seen that subsurface soil conditions will vary, even on a single construction site. It is quite true that many times what is below ground is not fully known until work is started, even though soil test borings may have been made to indicate conditions.

In Pittsburgh, borings were taken in the four corners of a 50-ft by 100-ft office building site, and 20-ft-long piles driven through hard coal ash and mixed fill were indicated. The design specified piles to be driven at 25-ft spacing. On the center line of the 100-ft dimension, 40-ft piles, instead of 25-ft piles, were required because there was a deep filled ravine across this line.

Excavations should be vertical wherever possible, so that concrete can be placed against undisturbed sides of excavations. Care should be exercised to excavate only the amount necessary, and that excavations be kept free of water and adequately shored to protect the banks.

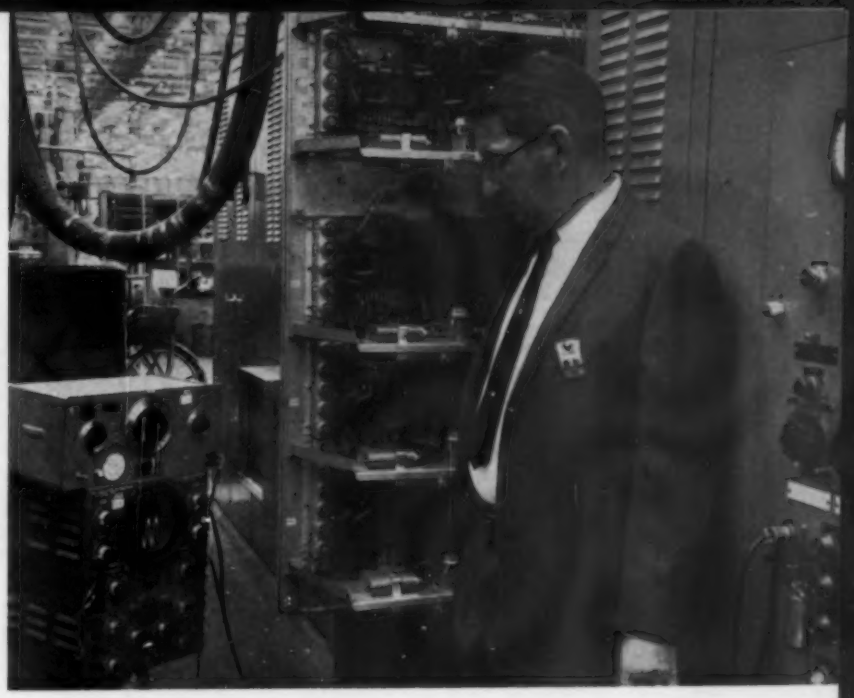
Where required bearing values are not obtainable at the elevations shown on the drawings, then excavation for footings should be carried down to suitable soil.

Disposition of excess excavated materials, including surplus earth materials left by the plumbing, heating, or other contractors after they have completed their work should be provided for. Final excavation and/or grading to the flat subgrade elevations required for footings, walls, bituminous paving, concrete paving, and floor work should not be made until immediately prior to the placement of these finishing materials.

BACKFILL. This work is very important, especially within building limits to prevent soft spots. Backfilling of open excavations around foundations, footings, and walls, and for subgrades for floor, paving, etc., should always be carefully done by placing fill materials in shallow layers and thoroughly compacting each layer to a specified compaction. Design of compacting equipment must meet the approval of the engineer.

FLOOR AND DRIVEWAY SUBGRADE. It may be necessary, after fills have been completed, to bring subgrades up to required elevations. Any soft, unstable, or otherwise unsuitable subgrade material should be removed and replaced with suitable materials and properly compacted. All surfaces must be compacted to the satisfaction of the engineer.

In subsequent articles in this series, the author will cover the specifications that should be written for each of the various mechanical and electrical trades on a construction project.



A technical diagnostician checks out the multiple electronic circuits on a tape-controlled machine. When the trouble has been found, a man without specific instrumentation training will be called in to do the actual work.

Borrow Instruments .. and Brains for BETTER, LOW COST MAINTENANCE

By **STERLING N. CHEW**, General Foreman, Properties Maintenance, Long Beach, California Division, Douglas Aircraft Company

PLANT MAINTENANCE, along with the remainder of industry, has definitely entered a scientific era. In many cases, human diagnosis of the troubles that occur in the machines and plant equipment employed to satisfy the demands of space age technology, of automation in its various aspects, and for ever-decreasing tolerances in more complex parts, is impossible. Some sort of instrumentation must be used to take over where human capabilities fail.

This places a new and two-sided responsibility on plant maintenance departments which have been running along smoothly for years. First, the employees must be trained to use the required instrumentation. Secondly, the instruments themselves must be acquired, or made available when needed.

The acquisition of numerous instruments is a costly procedure. Here at the Long Beach, California Division of Douglas Aircraft Company, we managed to avoid much of this cost by what we'll call plantwide cooperation in the use of instruments already on hand. The maintenance department in almost any plant can follow the Douglas example by pointing out to management the amount of money that can be saved by this cooperative effort.

Specifically, this cooperative plan makes it possible for the Douglas Maintenance Department to "borrow" instruments and the knowledge to use them from other departments when another department happens to have the required equipment and the experience to use it.

Here the word "borrow" is used in a qualified sense, for in some cases the other department does all the work, then issues a report to the Maintenance Department. In both cases, either when instruments are actually borrowed, or when another department does the work then issues a report, the over-all results are the same—the company is saved the cost of special instrumentation and laboratory facilities for use solely by maintenance personnel.

We have found that by proper preplanning, and except in emergency cases, this borrowing seldom interferes with the work of the other departments. When a plant is not running three full work shifts, work hours can be staggered so that the borrowing can occur while the other department is shut down. Even when some overtime is involved, it is economical in comparison with the cost advantages realized.

Of course, this plan applies simply to those instruments and services which are only occasionally required. But a quick run-through of maintenance jobs requiring the use of instruments will reveal that a great many of them fall in this category. At the same time, when an instrument or a specialized service is needed, it is usually an absolute necessity, and to play a bit on words, "if it can't be borrowed, it must be bought!"

Let us say, for instance, that a pipeline, a pressure vessel, or a critical machine casting must be X-rayed for possible defects. Here at the Long Beach Division of Douglas, one of the production departments uses a

portable X-ray unit for inspecting assembled airplane structures. When the Maintenance Department is faced with one of the above problems, it merely "borrows" the X-ray unit and its operator from the production department during that department's off hours, or during hours when the X-ray is not being used in production inspection work. This eliminates the need of the Maintenance Department investing in its own X-ray inspection equipment.

Or perhaps a leak is suspected in a pipeline carrying a gaseous material. The Douglas plant fire department has sniffer test equipment which is only occasionally used, so why should the Maintenance Department invest in duplicate equipment which would spend a large proportion of its service life "on the shelf"? Under the cooperative plan now in effect, the fire department equipment and its operator are "borrowed" to do what is normally a maintenance job.

But by far the greatest advantages that accrue from this cooperative effort result from the use by the Maintenance Department of the Process Engineering Department's laboratory facilities, test equipment, and personnel. These advantages accrue, not from the repetitive frequency of jobs performed, but from the numerous different jobs occasionally performed.

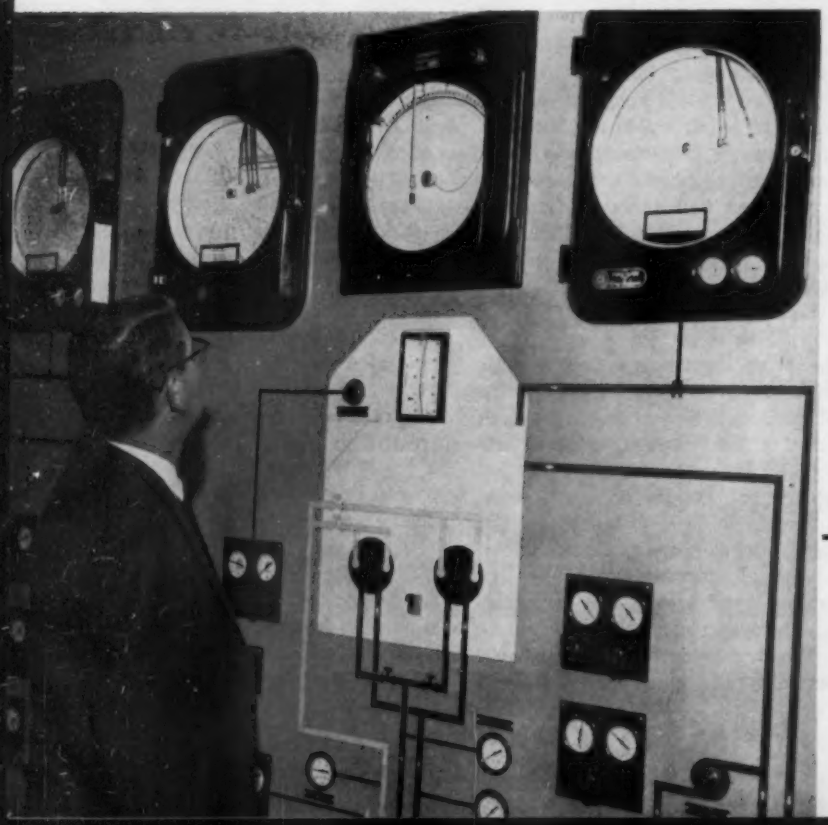
Thus when an extensive painting program is in the offing, Process Engineering can be called upon to check the contents, wearability, abrasive resistance, color match, and fire retardant characteristics of the paint selected, or of different paints until a proper selection can be made. The same applies to plant lubricating oils and greases, to the many synthetic materials now used in maintenance work, and to metals regarding their hardness, tensile, yield, and shear strength. The cost of the Maintenance Department conducting these tests independently would be prohibitive, due both to the equipment and facilities required and the need for specially trained personnel.

Over and above this cooperative effort, the Maintenance Department at Douglas Long Beach has managed to keep its instrumentation acquisition costs down by designing and building some of its own instruments and testing and checking equipment. As an example, an instrument for checking the insulating properties of transformer oil was designed and built within the department.

In another instance, permanent recording instruments were installed on all air compressors. These instruments not only show compressor loading at all times and total plant demand, but by interpolation, will reveal the general efficiency of the compressor and the amount of wear that has occurred. Thus maintenance or overhaul can be accomplished before efficiency drops low enough to create an excessive cost factor.

The cost of the second facet of this new responsibility now faced by many maintenance departments—that of training personnel to use the instruments now required—was drastically reduced at Douglas by training a few men only to be executive diagnosticians. When trouble occurs which must be diagnosed by instruments or other testing equipment, one of these specially trained men is called in to diagnose the trouble and specify how to correct it. A mechanic without special training then proceeds with the work. At the completion of the job, the diagnostician is again called in to check it out, using whatever instrumentation or test equipment is required. (See "The Technical Diagnostician," PLANT ENGINEERING, Jan., 1961, page 133.)

The cost of training these few men was much less than would be an instrument training program for all departmental personnel. **End**



Above: Some instruments can be built far cheaper than they can be purchased. This instrument, built in the maintenance department, is used to check insulating properties of oil.

Left: Diagnoses of charts and records often reveal when maintenance is needed. This saves cost of special instrumentation to do specific job.

TRAINING MAINTENANCE WELDORS

Part II - WELD FAULTS, CAUSES AND CORRECTION

By JOHN W. RANTALA and JACK ARZOOMANIAN, Training Div., Maintenance Dept., Abbott Laboratories, North Chicago, Illinois

OBJECTIVE of this part is to provide information to help identify various common weld faults, to determine what causes these faults and to make suggestions on how they might be avoided or corrected. Weld faults in gas and arc welding may be classified in terms of three general groups; improper dimensions or shape, internal defects within the weld, and cracking of the weld or base metal. The correction of these faults is almost wholly within the control of the weldor.

Overwelding is a common dimensional fault. Oversized welds result not only in a loss of time and materials but frequently cause excessive warping. Excessive reinforcement of butt welds causes a concentration of stresses at the toes of the weld when it is put under a bending stress.

An example of overwelding shows that a 50 per cent increase in dimensions results in more than double the amount of weld metal being deposited. In Fig. 30, we have a correctly welded tee joint in which a ¼-in. fillet was specified. We can see that four triangle volumes of metal were required. In Fig. 31, however, increasing the fillet to ⅜ in. uses nine triangle volumes of metal. This represents a 100 per cent increase in welding costs.

Oversized welds are not desirable but undersized welds in a highly stressed joint are not permissible. The size and spacing of welds is frequently left to the judgement of the weldor. In some cases, weld symbols and notes are used by the plant engineer to indicate the size and spacing of welds. These symbols and their interpretation will be presented later.

In the hope of gaining time, the weldor might select a smaller electrode than should be used. No time is gained however, as studies of burn-off rate for electrodes of different sizes indicate that each takes about the same length of time. About 75 seconds of arc time is usually required to melt 12 in. of electrode with normal machine settings.

Another dimensional fault is incorrect weld shape. The face of the fillet weld made by gas welding tends to be slightly concave. On the other hand, single-pass arc welds may be concave, straight across or convex depending upon the type of electrode used, position, current value and speed of travel.

Excessive concavity, Fig. 32, reduces the throat of the weld so as to greatly reduce the strength of the weld itself. Excessive convexity, Fig. 33, causes a concentration of stresses at the toes of the weld when it is under a bending stress. This may, on occasions, cause the base metal to fail adjacent to the weld. In Fig. 34, we see the desirable weld shape for maximum strength and minimum stress.

Overlap, Fig. 35, is commonly found in fillet welds. It may occur on the face of a vertical fillet weld or overhead fillet weld. If these overlaps are buried within the weld by additional passes, they become "cold shuts" within the weld. Typical overlap welds in lap and tee joints are shown in Fig. 36.

Undercut is a condition in which the base metal has been washed away by the force of the arc or gas flame while it was in the molten state, Fig. 37. This undercutting is a normal occurrence during welding but under proper welding conditions, the molten metal momentarily removed is replaced by the molten filler metal. Some of the causes of undercutting are improper electrode or torch angle; improper electrode, torch or rod manipulation; too high a current value or too large a tip; a harsh flame or a small filler rod. Additional examples of undercut welds for butt and lap joints are shown in Fig. 38.

Porosity is a term used to describe an internal defect consisting of small hollow spots, pockets, or bubbles of gas that were trapped within the solidifying metal, Fig. 39. The gases

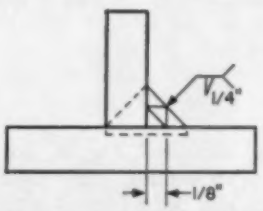


Fig. 30. Four triangle volumes of metal used for correct ¼-in. fillet.

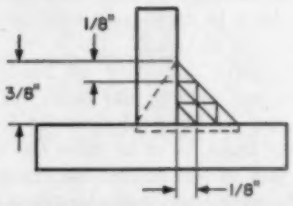


Fig. 31. Increasing fillet to ⅜ in. uses nine triangle volumes of metal.

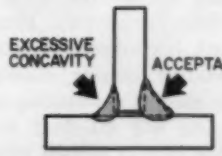


Fig. 32. Excessive concavity reduces weld.

Fig. 33. Convex weld concentrates the stress.

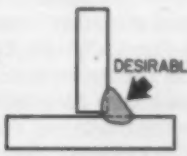


Fig. 34. Weld shape for high strength joint.

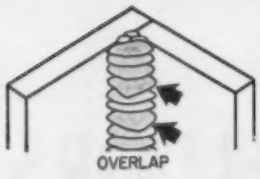


Fig. 35. Overlap may occur on face of vertical or overhead fillet weld.

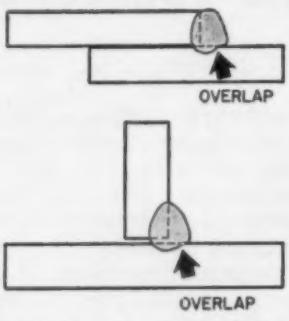


Fig. 36. When overlaps are buried within weld they are "cold shuts".

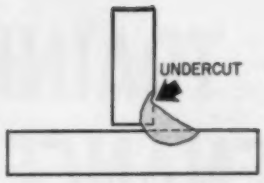


Fig. 37. Undercut weld has molten base metal washed away by arc force.

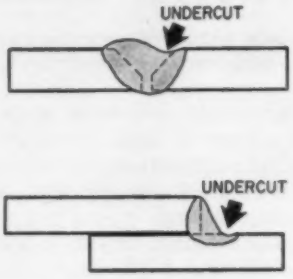


Fig. 38. Butt and lap joints may be undercut by improper electrode angle.

molten state before the rod is added. Melting rod over solid base metal increases the chance of flux inclusions. Positioning the joint so that molten metal tends to "spill out" ahead of the weld crater or pool may trap fluxes.

When arc welding aluminum with a flux-coated rod, flux inclusions may occur if high rounded beads are deposited in a multi-pass weld. Preheating and holding the molten pool in a fluid state permits gases and fluxes to rise to the surface. When gas welding cast iron or cast aluminum, stirring of the molten pool may help reduce flux and gas inclusions.

Whenever two adjoining surfaces within a weld have not fused together, we have a condition referred to as lack of fusion, Fig. 42. This lack of fusion can result from not raising the temperature of the base metal or previously deposited weld metal to the

TRAINING MAINTENANCE WELDORS

are formed by chemical reactions in the molten weld metal. During cooling of the weld, these gases are released to form bubbles. If these bubbles do not reach the surface while the metal is molten, they are trapped in the metal to become hollow spots.

Welding of greasy or oily metal will cause porosity. Excessive welding heat that causes weld metal to boil may result in porosity. Free machining steels will not weld satisfactorily because of the excessive porosity forming in the weld.

Use of low hydrogen electrodes is sometimes helpful in welding steels that are subject to porosity. A change in the length of the arc or electrode manipulation may also help to reduce porosity.

Another internal weld defect consists of any nonmetallic solids that are trapped within a weld. These are called inclusions and are of three general types; oxide inclusions, slag inclusions, and flux inclusions.

Oxide inclusions, Fig. 40, are created when the hot and molten metal is chemically attacked by the oxygen in the atmosphere. Several kinds of provisions have been made to reduce this oxidation. The use of fluxes, shielding gases, electrode coatings and proper welding techniques are all designed to reduce oxide inclusions.

In gas welding, allowing molten filler metal to drip into the weld pool introduces needless oxides into the weld. In most cases, it is best to add the filler rod by dipping it into the center or the forward edge of the molten pool. Either gas or arc welding over heavily oxidized, rusted or scaled metal will cause oxide inclusions.

Slag inclusions, Fig. 41, are common to arc welding. They result from molten slag being trapped within the weld metal. Use of too large an electrode in making the root pass or failure to adequately clean each successive bead in multi-pass welding will cause slag inclusions.

Excessive convexity of beads in multi-pass welding may cause slag inclusions. Holding the electrode at the wrong angle, so as to cause the molten slag to run around the crater to its forward edge, may also cause slag inclusions.

Flux inclusions are most common to gas welding and are the result of improper welding techniques. Fluxes used for cast iron fusion welding, aluminum welding, brazing, stainless steel welding, magnesium welding and silver soldering will all float very readily on the face of molten metal.

In fusion welding it is important that the base metal is brought to the

Fig. 39. Porosity occurs when gas bubbles are trapped within the weld.

Fig. 40. Oxide inclusions are caused by oxygen reacting with the weld.

Fig. 41. Slag inclusion results from molten slag being trapped in weld.

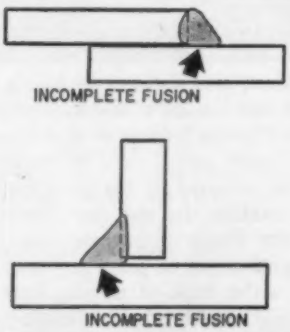


Fig. 42. Lack of fusion describes weld that has not fused together.

melting point so as to cause it to combine or fuse with the added filler rod.

Lack of fusion or incomplete fusion can also be caused by the existence of a heavy oxide film on the surface of the molten weld pool. Unless this film is dissolved chemically with the flux or broken up mechanically by rod, torch or electrode manipulation, it will prevent fusion of added weld metal with the weld pool.

Dirt, paint and other foreign materials may contribute to incomplete fusion. Mechanical or chemical cleaning of the surfaces of the weld joint, plus proper heat and manipulation of the torch, rod or electrode will prevent incomplete fusion.

When incomplete fusion occurs within the cross section of a layer or multi-pass weld, the defect is commonly referred to as a cold shut, Fig. 43. If such a weld is deliberately fractured by bending, the cold shut becomes very apparent as a separation within the weld.

Failure to melt a weld joint to its root and to fuse the weld metal with the base metal is called lack of penetration or inadequate penetration. Some of the causes for lack of penetration are not enough space at the root of the joint or between the pieces, Fig. 44. In these cases, excessive heat would be needed to obtain the required penetration.

Using too large an electrode for the root pass, Fig. 45, is another cause of lack of penetration. The large electrode causes the weld metal to bridge from one member to the other at a point above the root. When the electrode is held at the wrong angle we are likely to find lack of penetration. In Fig. 46, the heat of the arc is so directed as to cause inadequate melting of the vertical piece.

Other causes of inadequate penetration are too low a current value, or too small a tip resulting in insufficient heat to melt the joint to its root, Fig. 47, or failure to preheat gas welded tee or lap joints, Fig. 48.

In a discussion of causes and correction of weld metal cracks, we find there are three general types of cracks. These are transverse cracks or cracks across the weld, longitudinal cracks or cracks occurring along the weld and crater cracks. These cracks may or may not extend beyond the weld metal into the base metal.

Whether or not a weld may crack longitudinally, Fig. 49, is dependent upon a number of variable conditions. Making the root pass of a rigid groove or vee joint with too thin a cross section is to be avoided as shrinking of the weld between the unyielding pieces places a severe stress on the weld. The first pass should be made as heavy as practical. Immediate peening after each pass tends to relieve stresses.

Whenever possible, loose jigging is desirable so as to provide some movement of the piece during welding. Tack welding of complicated assemblies into one rigid unit traps many stresses needlessly. Wherever possible, a progressive sequence of tacking and welding should be used to provide for a continual escape of stresses as the welding progresses. This technique also helps to keep warping of the completed structure within allowable limits.

Welds of inadequate penetration cause a concentration of stresses at the root of the joint. If the weld is subjected to a severe tensile stress across the weld, the joint should be prepared to provide for a weld throughout the entire cross section.

Heavily welded units or sections of comparatively thick metal are usually stress relieved by peening or heated to 1000 F after welding. Some metals such as cast iron are more subject to cracking because they have very low ductility. Over-all uniform preheating and slow cooling helps to reduce uneven shrinkage stresses and thereby reduces the tendency to crack. Cast iron should be preheated to 800 F and cast aluminum to 700 F.

Arc welding of cast iron with a highly ductile electrode and low heat input helps to reduce cracking. This technique calls for a small electrode, short welds of one inch or less, low current, light peening and adequate time intervals between welds to allow for cooling to hand-touch temperature.

A few metals such as aluminum must be well supported during preheating and welding or they will crack while hot. Crater cracks are often the source of longitudinal cracks through the weld. Whenever a weld is ended at the edge of sheets or plates, it is particularly important that the crater be filled.

Transverse cracks, Fig. 50, are

Fig. 43. When incomplete fusion is within the weld, it is a "cold shut".

Fig. 44. Failing to melt and fuse a weld joint is lack of penetration.

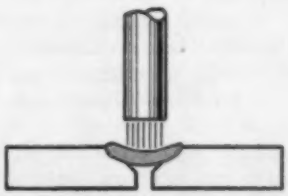


Fig. 45. Lack of penetration may be due to large electrode on root pass.

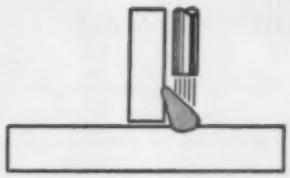


Fig. 46. Wrong electrode angle causes lack of penetration on vertical piece.

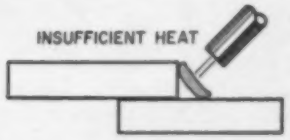


Fig. 47. Low current or small tip will not supply enough heat to melt joint.

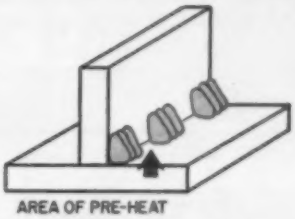


Fig. 48. Failure to pre-heat gas welded joint causes poor penetration.

cracks running across the face of a weld and are related to welding procedures and to the metallurgical properties of the base metal and filler metal. A considerable difference in the amount of shrinkage in the weld metal and adjacent base metal may be a contributing cause of transverse cracking.

A lower degree of ductility of some alloy electrode deposits may cause a weld to crack transversely on cooling. This is quite common to air-hardening alloys.

Minute transverse cracks, relatively widely spread, may not be particularly harmful to some applications such as hard facing. Some of the welding procedures that may help reduce transverse cracking are: preheating, peening, interpass heating, post heating, slow cooling, and use of ductile filler metal as a base for hard facing materials.

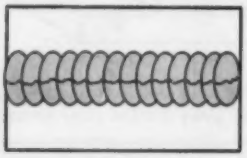


Fig. 49. Longitudinal cracks are caused by thin section in root pass.

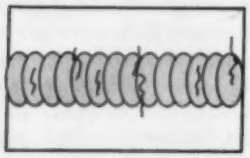


Fig. 50. Transverse cracks are cracks running across the face of the weld.

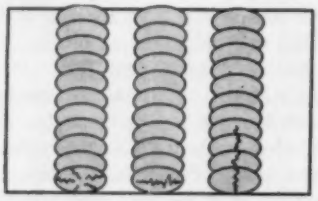


Fig. 51. Crater cracks frequently appear in crater left when arc is broken.

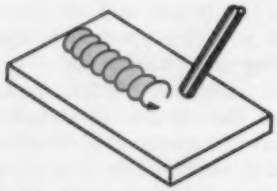


Fig. 52. Using proper techniques, crater cracks can be melted into the weld.

When an arc-welding electrode is consumed and the bead is ended, a crater is left at the point where the arc is broken. Shallow shrinkage cracks, called crater cracks, frequently appear in this crater, Fig. 51. These cracks are easily melted to their root depth upon restarting the bead with a new electrode.

The proper technique must be used, however, to melt these crater cracks. One way is to clean the crater and then strike the arc ahead of the crater. Holding a long arc, move back into the crater, shorten the arc and build the crater up to the desired height of weld. Then, move forward in the normal manner, Fig. 52.

Another method is to clean the crater and approximately one inch of the end of the weld. Strike the arc behind the crater and weld over the last inch of weld and crater proceeding in a normal manner, Fig. 53.

When a weld is terminated at the end of a joint the crater should be filled. One method of doing this is to weld out to the edge of the plates or end of the joint and then hook the weld back so as to leave the crater on top of the weld or alongside the weld, Fig. 54.

Another method of filling the crater is particularly well adapted to butt welds in plates. As the bead is welded out to the edge of the plates, the arc is shortened and "snuffed out" momentarily. The electrode is raised before it freezes and more filler metal is deposited in the crater. The operation is repeated until the crater is filled, Fig. 55.

Carbon and alloy steels will harden to varying degrees depending upon the carbon and alloy content. To harden steel it must reach a critical temperature of about 1350 F and then be cooled rapidly. If the weld and adjacent base metal cool slowly down through the critical range, they will not harden and therefore, are not likely to crack.

Addition of certain alloying elements in steel increases toughness and tensile strength so as to make them more suitable for some applications such as pressure piping. These same alloys, however, decrease the cooling rate necessary to harden the metal. For this reason they are more subject to cracking. Preheating and post heating are means of slowing down the rate of cooling and removing stresses to reduce cracking.

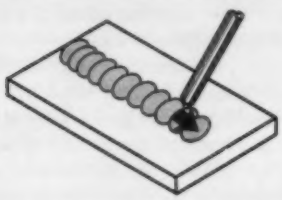


Fig. 53. Welding over the previous weld eliminates crater cracking.

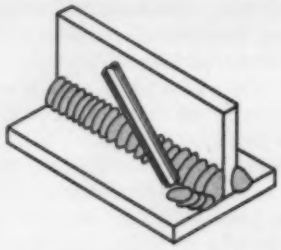


Fig. 54. Welding out to the end and hooking back eliminates crater cracks.

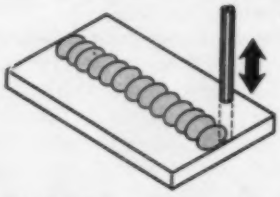


Fig. 55. Snuffing arc momentarily and filling crater solves crater cracking.

Fig. 56. Low hydrogen electrodes can help eliminate underbead cracking.

If the high strength, high carbon and alloy steels are welded with ordinary coated electrodes, cracks may develop under the bead, Fig. 56. The moisture content of ordinary electrodes releases hydrogen that causes this destructive cracking. Low hydrogen electrodes, Specification 6015 and 6016 of the American Welding Society, eliminate much of this cracking. **End, Part II**

Watch for Part III in the next issue, on selection of electrodes.

GEODESICS IN ACTION — STORAGE DOME IN A KIT

LIGHTWEIGHT, free-standing, weatherproof—these three attributes characterize a geodesic dome structure now available to industry.

Constructed of triangular sections of ½-in.-thick Fomecor board—a polystyrene foam, kraft paper sandwich—the dome is bolted together on the construction site, as shown in the progress photos on this page. The building is manufactured by Filtered Rosin Products Company, a subsidiary of Monsanto Chemical Company.

This ready-to-assemble dome, trademarked "Geospace," is bolted together and staked down to form a self-supporting shelter, 21.2 ft in diameter and 12.5 ft high at the peak. It offers 352 sq ft of floor area and approximately 3000 cu ft of storage space. Cost—about a dollar a square foot of floor area.

The triangular panels making up the skin of the dome are factory-dipped in plastic-based paint, to provide weather resistance. The manufacturer claims a minimum service life of five years with normal maintenance.

The dome is shipped to the user in three packages, plus an uncrated steel-pipe erection mast, and is intended to be erected by semi-skilled construction men. At Monsanto's Krummrich plant, near St. Louis, Mo., the first construction site dome was recently erected. PLANT ENGINEERING's construction editor Andy Anderson was on the site, following the progress of the crew, whose familiarity with the dome consisted of a limited study of the erection manual that accompanied it.

Beginning at eight o'clock in the morning, fighting a strong wind all morning, a crew of four men was able to install and stake down the dome in approximately six hours. It should be noted that two of the men were occupied a considerable portion of the time, fighting the wind, rather than participating actively in the erection process. The addition of the door completed the structure, well within a day's working time.

The dome is erected on a steel pipe mast, fitted with five extension arms near its tip. These arms, and the top of the mast, support the dome as it is assembled. Following the attachment of each "course" of panels around the dome, the mast is extended, to raise the peak of the dome, thus facilitating the fastening of the next course of panels.

Progress photos, starting from top left, show how geodesic dome is erected on site. Telescoping central mast facilitates construction of the building from the top down.

Upon completion, the bottom edges of the panels are secured to a wooden base ring, and the dome becomes self-supporting. The steel erection mast is then removed, and the base ring is staked to the ground.

Once erected, the dome can be staked down, or lifted and carried (it weighs only 350 lb) to a nearby location. And, at the end of the current project, it can be disassembled and transported to another site for reassembly. **End**

For Additional Information

If you would like to receive more information about this item, indicate "Geospace" on the post card in this issue, or write to The Editor, Plant Engineering, 308 E. James St., Barrington, Illinois.

Moisture, dust and high operating temperatures are of no concern to magnet coils now that they have been insulated with epoxy. That is why . . .

TOUGH-SKINNED MAGNET COILS JUST SIT THERE AND TAKE IT

EPOXY ENCAPSULATION of magnetizing and demagnetizing coils substantially reduced maintenance costs at a northern Minnesota taconite processing plant, during the three years following adoption of the resin insulation method. The heavy coils, used in the process which separates the taconite from waste materials, are subjected to extreme moisture, dust and high operating temperatures.

The original coils, insulated with tape and varnish impregnation, lasted only two to four months under these difficult 24-hour-a-day operating conditions. Replacements were made on the average of nearly two coils a month at a purchase price of $450 per coil. Downtime and labor costs further increased the expense of coil replacement.

No Moisture Failures, Now

Since encapsulating the coils in epoxy, there have been no failures due to moisture, dust or normal operating temperatures. Encapsulated coils fail only when physically damaged, according to the plant electrical maintenance supervisor. In addition, replacements are provided at two-thirds the cost of the original coils—$300 for large 54 amp, 440-v coils, and $180 for smaller 38 amp coils which operate on 110 v.

The primary cause of coil failure was the constant presence of moisture, along with fine iron-bearing, electrically conductive dust. A demagnetizing coil surrounds each of the outlet pipes at the concentrate discharge boxes where the finely ground taconite, suspended in water, passes from the rod or ball mills to magnetic separators. As the pulverized material and water pass through the six-inch outlet pipes and the magnetic field created by the energized coils, the taconite is electrically neutralized. It was possible for water from the discharge box, settling on the older type of coil, to seep in, destroying the insulation.

A further hazard was the residue

Fig. 1. Left: Nylon web sling is used to handle the coil cores.

Fig. 4. Right: Coils, under box, are often soaked in moisture.

Fig. 3. Above: Spare magnet coils are made up in advance and kept on a standby basis in case of physical damage to any coils.

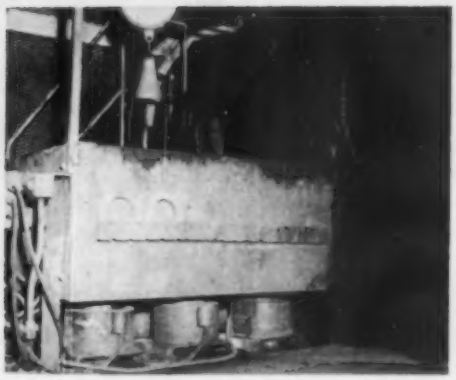


Fig. 5. Right: Another view shows sludge dripping from the cylindrical section at right.

Fig. 2. Left: Steel bobbin on which coils are wound is shown at left. At right, coil has been set in mold. Note pocket to accommodate the coil lead.

of taconite-bearing material accumulating on the exterior of the coil. As it built up, it reduced the heat dissipation of the coils, further contributing to deterioration of the insulation. With the coils encapsulated in moisture-proof epoxy, it is now possible to keep the area beneath the discharge boxes hosed clean, preventing a buildup of the silt-like residue. In addition, the epoxy is capable of withstanding higher constant operating temperatures than other types of insulation.

Failures in encapsulated coils are now restricted to external causes. One coil "blew up" when water flow through the outlet pipe became restricted, reducing the heat transfer required in the design of these coils. Other coils fail when the highly abrasive taconite and silica solution wears through the outlet pipes, then through the epoxy, baring the coil wires and causing a direct short.

Coils are built entirely in the electrical shop. The windings are No. 3 square copper wire, weighing up to 285 lb for the large coils, wound on a specially constructed steel bobbin chucked in a lathe. When the coil is wound and removed from the bobbin, it is tied. The connections to a 10-ft lead are completed and the coil is placed in a steel mold designed and built in the company's shops.

The molds, shaped like huge cake pans, are coated inside with a silicone grease release agent. Placed in a nylon webbing sling, to prevent the release agent from rubbing off, the coil windings are lowered into the mold. Once in the mold, the coil is centered with small wooden wedges which are removed after the mold is set into the pre-heat oven.

These molds have an offset pocket with a packing gland to seal the hole where the connecting lead passes through the bottom. The pocket, filled with resin, provides a sealed outlet for the lead and eliminates the need for a junction box.

The coils—in their molds—are preheated to either 200 or 250 F, depending on which of two types of resin is being used. Until recently, all coils were encapsulated in "Scotchcast" brand electrical resin No. 241, a two-part semi-flexible epoxy, capable of continuous operations at Class B (130 C) temperatures. Pre-heat temperature for this resin in the coil application is 250 F.

In recent months, as coils have been damaged or require replacement, they have been encapsulated with a new resin. Both resins are supplied by Minnesota Mining and Manufacturing Co. No. XR-5030. The new material is a one-part resin, which eliminates mixing and pot-life problems, is fully flexible for increased thermal shock resistance and is rated at Class F (115 C) continuous operating temperatures.

After the mold has been poured, the resin is cured at a temperature of 220 F for a period of 16 to 18 hours. Both resins are cured on the same temperature/time cycles. **End**

Part III

ELECTRIC TRUCKS AT CRANE

By **LOUIS MARTH**, Manager, Material Handling Operations,
WILBUR T. JOHNSON, Superintendent, Material Handling Operations and
ARNOLD J. HAMILTON, Supervisor, Transportation Section and Garage
all of Crane Company, Chicago, Ill.

IT IS AN UNUSUAL experience for a company to receive a letter from a firm in the business of supplying preventive maintenance service which says in part—

"In the writer's opinion, it would not be possible for our company to maintain your equipment for any less money than what you are currently spending—because of your very excellent maintenance program at this time."

Such statements have become almost routine at our Chicago Division plant since we implemented a controlled maintenance system. Added to these has been a $32,000 annual truck repair cost reduction, as evidenced by monthly budget reports.

Our interest in preventive maintenance for power trucks was translated into action when an in-plant vehicle utilization survey exposed faulty repair practices. (Part II, PLANT ENGINEERING, April, 1961, page 114.)

Since one of the principal recommendations of the material handling committee was the organization and adoption of a preventive maintenance program, a preventive maintenance committee was formed. This comprised key personnel from top management levels.

As a start, to properly evaluate a program designed to suit our operational requirements, the committee selected a cross section of industry in our metropolitan area, for the purpose of observing their methods of control, costs, maintenance schedules and traversing areas.

We visited four major manufacturing plants and one major airline in the Chicago metropolitan area. Two of the five locations had a preventive maintenance program while the other three practiced maintenance on a breakdown basis.

In all instances, we noted that the ratio of service personnel to rider-type vehicles average one to 10.

All vehicles were in an age bracket of one to 15 years. In no case did we encounter a vehicle above this age. Only two plants in five recorded length of time vehicles were out of service, and only one made use of this data. Three firms recorded repair costs, only one of three using the costs to evaluate replacement of equipment, while two used costs to record preventive (routine) and repair (non-routine) expenses.

It was the consensus of the committee that the two firms employing the preventive maintenance program had better control and obviously better looking equipment. Another point in favor of the program was that the company controlled the vehicles, not vice versa.

Suffice it to say that observations in the field further strengthened the conviction of the committee that a well planned maintenance control program in an operation of this size was definitely a must. The following proposal was developed by the committee and submitted to management for their consideration and approval.

In view of what, in the opinion of the committee is a prerequisite to efficient operations, we propose that the Chicago Division establish a preventive maintenance program for their material handling trucks. This program is to continue on a trial basis for a two-year period, during which time proper and complete records will be kept to evaluate justification of the system on a dollar and cents basis, instead of on committee opinion.

To set up proper controls for preventive maintenance of vehicles, it is necessary to develop and establish a record system for each individual piece of equipment. With the preventive maintenance program in effect, these records will furnish all cost data for repairs and downtime. Only by such records can the cost of a material handling system be determined and continuously be evaluated.

A well planned preventive maintenance program assures continuity of service with minimum delays caused by mechanical failures. It promotes safety and prolongs the economical operating life of equipment.

The basis of an adequate preventive maintenance program is the establishment and utilization of a maintenance schedule set up for cleaning, inspecting, checking, testing, lubricating and adjusting the various truck components to prevent avoidable major truck failures.

Operating costs of material handling equipment as well as the degree of efficiency, will vary in direct proportion to the effectiveness of the preventive maintenance rendered.

To implement this program and provide the service required in the operation of washing, greasing and inspection, it will be necessary to add two employees to our payroll at an approximate cost of $12,000 annually.

The physical plant facilities required for this program include an addition to the northwest corner of the garage and an opening in the existing north wall. This will enable us to drive the trucks into the enclosure and provide sufficient room for the washer to walk around the truck on all sides while cleaning. This will require an expenditure of approximately $3500.

To speed up the inspection of the vehicle itself, it will be necessary to install an additional truck hoist. With this installation, the mechanic can make under-carriage inspection quickly and by elevating the truck, can inspect the drive motors, lift motors, brakes, brake drums and the hydraulic pump. With this facility, we shall

Truck Inspection Procedure

If you would like a copy of Crane's step-by-step inspection procedure for industrial trucks, write "Truck Inspection Procedure" on the post card in this issue, or write to The Editor, Plant Engineering, 308 E. James St., Barrington, Ill.

reduce the inspection time by one-half hour for each truck. An expenditure of $3000 will be required for the installation.

For further control, we recommend the installation of 165 engine hour meters on rider-type vehicles at a cost of $9400. (We finally installed 171 meters at approximately half this cost.) These meters will serve a two-fold purpose:

1. A control for scheduling the 100 and 1000 hour inspections. The Transportation Department checks reading and delivers vehicles scheduled for an inspection cycle to the garage.

2. The meters are also used to measure the ratio of vehicle operating hours versus various factors, i.e.,

a. Maintenance hours required
b. Productive units (hours, etc.)
c. Average hourly operating cost
d. Evaluation of competitive makes

When a truck is sent into the garage for routine inspection, a check card is filled out for the first and subsequent 100 hour inspections. See Fig. 1. The check card covers the various points necessary to maintain a vehicle in good operating condition. We also require a detailed step-by-step performance manual so that the inspector will have no doubt as to what must be done in checking the various steps. This reduces the possibility of careless inspection and maintenance as the program becomes routine. When the preventive maintenance system becomes effective, which we estimate would take at least eight months, we expect to be able to effect the following:

1. Release one driver and two mechanics at an annual savings of $18,000

2. Reduce number of vehicles now needed as standby, by at least eight, at an estimated replacement value of $65,000

3. Reduce waiting time on production floor by approximately 90 per cent

The preventive maintenance system, through the use of the engine hour meters will provide an excellent managerial tool for evaluating the use of the trucks in various areas. It will also provide a definite means of establishing proper manpower requirements in the garage as the hourly use of trucks fluctuates.

Cost controls necessary for the establishment of a preventive maintenance system have already been determined and put into effect. The procedure was changed so that all repair costs are charged to individual vehicles.

Labor and parts are now charged directly to the vehicle asset number by means of I.B.M. cards using a code system. These cards are accumulated and a tabulating run is made monthly, showing:

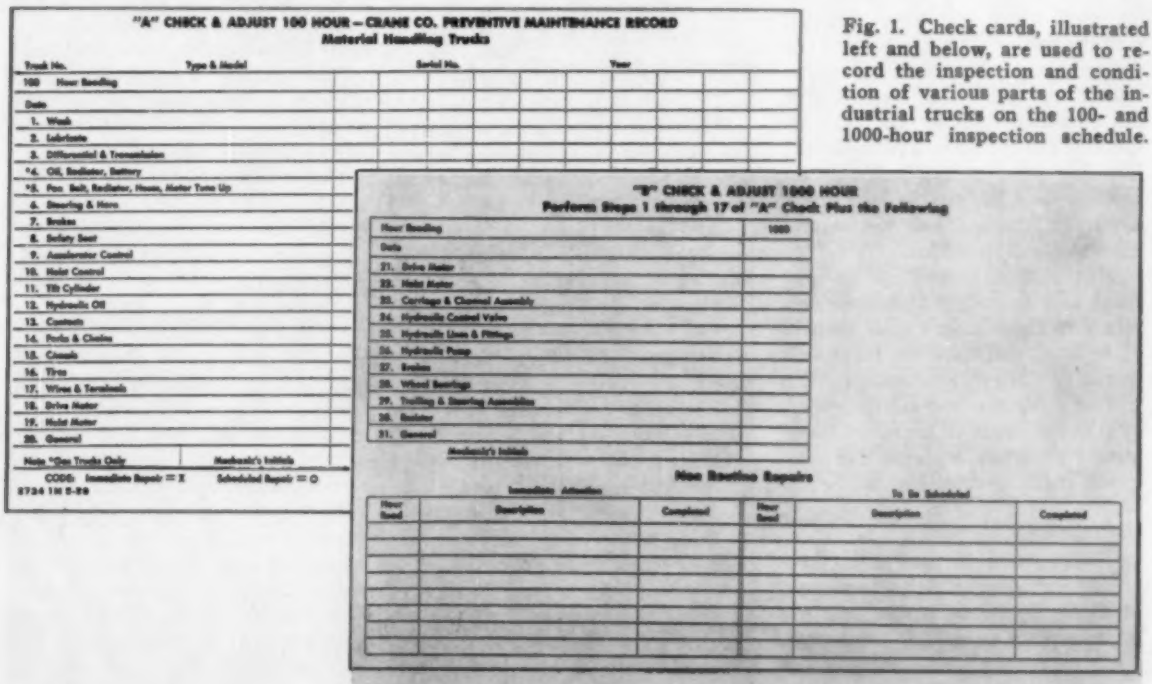
Asset No.
Manufacturer
Type of vehicle and capacity
Type of power
Special purpose features
Procured, new or used
Age in months
Purchase cost
Current year to date repair cost
Average annual repair cost
Allowable repair cost
Accumulated repair cost (signaled if excessive)

To evaluate the benefits derived from a preventive maintenance program, a method of measuring vehicle downtime will be established.

An I.B.M. card has been designed (See Part II, PLANT ENGINEERING, April, 1961, page 114.) for this purpose. It provides this information:

Foreman's signature
Number of shifts truck operates
Asset No.
Location
Date and time in
Date and time out
Total downtime
Description of work required

The card shall accompany each ve-



"A" CHECK & ADJUST 100 HOUR – CRANE CO. PREVENTIVE MAINTENANCE RECORD
Material Handling Trucks

Truck No. | Type & Model | Serial No. | Year

100 Hour Reading
Date
1. Wash
2. Lubricate
3. Differential & Transmission
*4. Oil, Radiator, Battery
*5. Fan Belt, Radiator, Hoses, Motor Tune Up
6. Steering & Horn
7. Brakes
8. Safety Seat
9. Accelerator Control
10. Hoist Control
11. Tilt Cylinder
12. Hydraulic Oil
13. Controls
14. Forks & Chains
15. Chassis
16. Tires
17. Wires & Terminals
18. Drive Motor
19. Hoist Motor
20. General

Note *Gas Trucks Only | Mechanic's Initials

CODE: Immediate Repair = X | Scheduled Repair = O

5724 1M 5-59

"B" CHECK & ADJUST 1000 HOUR
Perform Steps 1 through 17 of "A" Check Plus the Following

Hour Reading	1000
Date	
21. Drive Motor	
23. Hoist Motor	
25. Carriage & Channel Assembly	
24. Hydraulic Control Valve	
25. Hydraulic Lines & Fittings	
26. Hydraulic Pump	
27. Brakes	
28. Wheel Bearings	
29. Trailing & Steering Assemblies	
30. Resistor	
31. General	
Mechanic's Initials	

Non Routine Repairs

Immediate Attention

Hour Read	Description	Completed

To Be Scheduled

Hour Read	Description	Completed

Fig. 1. Check cards, illustrated left and below, are used to record the inspection and condition of various parts of the industrial trucks on the 100- and 1000-hour inspection schedule.

hicle sent to the garage for repair. The foreman in charge of the vehicle signs the card and fills in required data. When vehicle arrives at the garage, time in is stamped on this card. When work is completed, time out is entered. Accrued downtime is totaled by the garage clerk and card sent to the Accounting Section for tabulation. The downtime data is incorporated with the repair cost data on the previously mentioned tabulating run.

Except for minor and incidental details, the above proposal was accepted and approved by management and set in motion without any further delay.

While contracts for building the truck wash area, Fig. 2, for the purchase and installation of a truck hoist, Fig. 3, and engine hour meters were being consummated, the technical details of scheduling, checking, inspecting and repairing vehicles with the least disturbance of production was worked out.

Our spare vehicle pool was inadequate to service both the repair of vehicles during what, at this time, was a normal routine and to service the inspection system. Consequently, the inspection system was initiated on the night shift when vehicles were available.

The engine hour meter on each vehicle was activated at the end of the first inspection, then a vehicle file card, which had been inscribed with the vehicle asset number and the use percentage as shown by a vehicle utilization survey, was marked with the estimated date for the next inspection and placed in a calendar file. One day prior to the indicated inspection date the vehicle hour meter would be checked and the vehicle scheduled for inspection.

This system proved to be very rough and unwieldy. It became necessary to check a very large number of vehicles daily and to index and rearrange file cards constantly. The cost of doing this was out of proportion to the value of inspection operation. Therefore a simple but adequate check system had to be installed. This was accomplished in the following manner:

Trucks were divided into three groups according to use performance; of these, the 60 to 70 per cent use group was the largest. It was numerically approximately twice the size of the 70 per cent and over group. The latter was in turn approximately twice the size of the under 60 per cent group.

It was determined that up to 30 meters could be checked per day at the battery charging station without additional personnel. A predetermined number of trucks from each group was checked and their respective file cards arranged with previously checked cards according to the highest number of hours of use. In our plant this amounted to 16 from the largest group, eight from the second largest group and four from the smallest group. From the highest reading cards of the three groups the head mechanic indicated which vehicles were to be inspected. This system proved effective and with minor variations was very satisfactory.

The preventive maintenance program was originated primarily as a washing, greasing and inspection operation. At the end of three days, the repair section could not keep up with the number of vehicles coming from the inspection system.

Inspection procedure was then broadened to include tightening of loose components and making minor adjustments by the preventive maintenance crew. This eased the congestion on the repair floor and reduced the number of vehicles requiring scheduled repair service.

PM Need Evident at Start

If proof of the need for a preventive maintenance system was necessary, it was forthcoming during the first cycle. Of the first dozen vehicles checked, we found that many of them had loose parts such as tie rods, motors, guards, chains, bolts or other components. This ratio continued for the entire cycle.

Consider this significant fact: The first vehicle to receive an unqualified O.K. without adjustment or repair was the 75th vehicle to be inspected!

Compare that, if you please, to our present ratio of five out of 10 trucks now being inspected receiving an O.K. without tightening, adjustment or repair being necessary.

In descending order of frequency, these are the truck malfunctions we encountered. After general looseness of components, there followed electrical contacts, controls and motor brushes, (on gas engines it was governor controls), steering and wheel bearings, emergency controls such as emergency brakes, deadman seat or foot pedal controls, then lift guide rollers and bearings, leaking hydraulic cylinders and fittings and other miscellaneous items.

During the first maintenance cycle, 16 truck defects that could have proved extremely dangerous or costly were found and remedied before they were allowed off the repair floor:

- The lift brake drum on a high lift truck was extremely loose. Failure of this part could have dropped a load from a maximum height of 10 ft.
- A safety cut-off was inoperative and speed contact points arced badly. The self-winding of the contact points could keep power applied to the drive motor without the operator having the means of disconnecting the power.
- On one gas truck a gasoline leak had developed over the exhaust manifold. If it hadn't been discovered a serious fire could have occurred.
- In several instances motor brushes were frozen and were damaging armatures on lift and drive motors. If this condition were left unrepaired, expensive motor repairs or replacement might result.
- Of the 171 vehicles inspected on the first cycle, 92 had to be scheduled for future repair.

Inventories were checked and where parts were in stock, the trucks were scheduled for immediate and near future repair. Parts that were not in stock were ordered for other vehicles needing repair and as soon as they were received the vehicles were scheduled for repair.

One vehicle called in for scheduled repair was not allowed to leave the repair floor until it was in top operating condition and had been repainted. When trucks arrived on the repair or inspection floor, unauthorized markings and writings were painted out and the vehicle stenciled with standard asset numbers, weight, capacity and department numbers. The department supervisor was notified of this action.

Unauthorized appurtenances attached by a vehicle operator, such as wires, cords, boxes, etc., were removed and the department supervisor notified. Persistence in applying this program resulted in the improved appearance of our equipment.

It was at this point that the reali-

zation struck home that ours was not in the technical sense a "preventive maintenance" system, but was in fact a controlled maintenance program. We did not prevent wear or the need for repair, but we did control both wear and repair so that a minimum of parts inventory, spare vehicles and personnel was necessary to run our equipment.

As an example, the high point in our repair parts inventory was approximately $70,000. Our present inventory is less than $15,000. Incidentally, the inventory is presently that high only because there are many large or expensive parts remaining from the original inventory, such as gas and electric motors, complete drives and wheel assemblies, etc., which will not be reordered for stock when they have been used.

A direct offshoot of the parts inventory check for specific truck repairs was the revelation of a condition in our stockroom which required attention. There were many parts which could be fitted to perhaps several different styles of truck except for minor differences. For instance, we stocked 17 different types of the same make hydraulic pumps. The differences were relatively minor. Long shafts, medium shafts, short shafts, large-medium or small outlets and inlets, differences in mounting flanges, etc. were the principal reasons for the numerous types.

By employing different length couplings, using bushings for various openings and threads and making special mounting attachments, we reduced the types of replacement hydraulic pumps kept in stock to only four.

Standardization of Parts

Awareness of this condition led to the standardization of many like parts and real savings and reduced inventory were realized on such items as tires, wheels and bearings.

All experiments did not turn out successfully, as witness the fact that we have not as yet found a fully satisfactory replacement in a zero pressure type tire for pneumatic tires. However, the successes far outweighed the failures and have given a substantial return for invested effort.

Here is a brief explanation of our method of record keeping employed for this equipment. On our inspection record card, Fig. 1, a colored tab was moved as inspections progressed from the first to the ninth inspection column. This showed at a glance the number of inspections a vehicle had received and indicated vehicles that were due for 1000 hour inspections.

For vehicles requiring a scheduled repair, a red tab was placed on the card. On the reverse of the card was indicated the repair to be made and the date on which parts were ordered. When parts were received, the stock attendant notified the head mechanic who then scheduled the vehicle for repair.

Another colored tab was placed on a card to indicate a vehicle having an experimental component. On the reverse of the card was inscribed the date, cost and nature of the experiment.

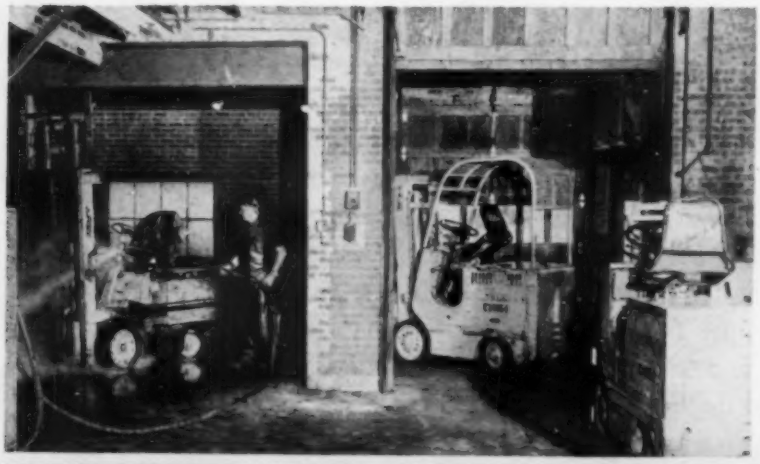
As the over-all condition of our trucks improved, the speed of inspection increased, and eventually walkie-type trucks were added to the maintenance inspection schedule. The original washing, greasing and inspection team was reduced from four to two men.

Refinements in the inspection procedure were partially responsible for this latter development. For instance, the standardization of inspection cover fasteners, which allowed their removal with a speed wrench; the fabrication of special waterproof covers for electric motors, etc., which allowed quick protection for electrical components; and increased familiarity and job know-how, all tended to facilitate the inspection procedure.

Another dividend of our improved vehicle condition was the release of vehicles from the production areas because of increased reliability of the assigned trucks and the assurance of a spare in the event of failure. This produced a spare vehicle line that was now adequate and as a result the inspection operation was transferred to the day shift. This afforded closer liaison between the inspection and the repair personnel.

Another result was the eventual

(Please turn to page 136)



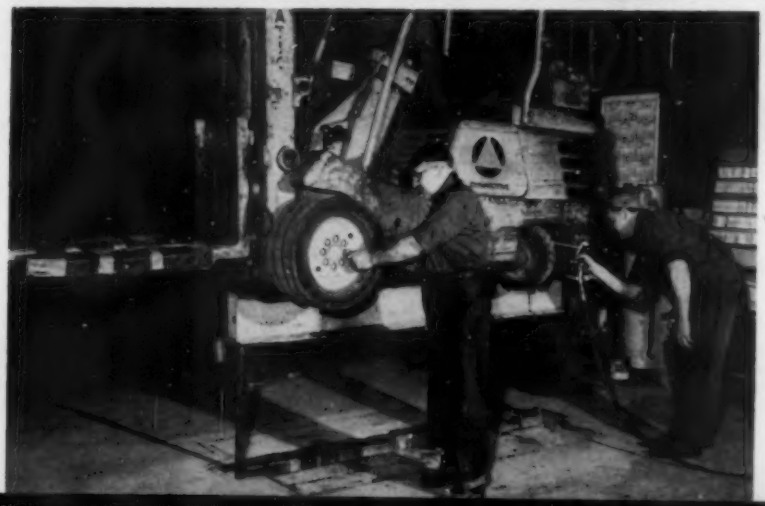


Fig. 2. Top: Additional space permits washer to walk all around trucks.

Fig. 3. Left: Another hoist was needed for undercarriage inspection.

SWITCH NOW AND SAVE THE DIFFERENCE

Here's how changing from copper to Rome's aluminum TW building wire can improve your profit picture

The figures in the table tell the story. An installation using *aluminum instead of copper building wire usually costs less.* Savings on wire cost vary with size, as indicated in the table. Simply select the size and multiply the difference in cost by the amount of wire required. It follows, too, that the more times you use aluminum, the more you save. And don't forget, lightweight aluminum is easy to handle. For example, 1000 feet of No. 1 AWG copper Type TW weighs 115 lbs. more than aluminum wire of equivalent current-carrying capacity. Those are pounds you *don't* load, unload or carry. The savings in dollars are obvious. And you'll appreciate the ease of handling with the first installation—and every one that follows. For the full story on Rome Aluminum TW wire, contact your nearby Rome distributor or sales representative. Or, write to Rome Cable Division of Alcoa, Dept. 5-51, Rome, N. Y.

Rome Synthinol Type TW with aluminum conductor is available in a full range of sizes starting with #6 AWG. Underwriters' Laboratories approved. The insulation, a thermoplastic compound, is flame-resistant, oilproof, easy to pull, free-stripping and has extremely high dielectric strength.

ALCOA
ROME CABLE
DIVISION

For more facts circle 567 on Reply Card

ROME SYNTHINOL BUILDING WIRE

TYPE TW – 600 VOLTS

Underwriters' Approved

COPPER			ALUMINUM			SAVINGS	
SIZE	NO. OF STRANDS	LIST PRICE	SIZE	NO. OF STRANDS	LIST PRICE	DOLLARS	PERCENTAGE (Approx.)
6	7	$ 67.30	4	7	$ 54.10	$ 13.20	20%
2	7	137.00	1/0	19	109.00	28.00	20%
4/0	19	406.00	300 MCM	19	311.00	95.00	23%
500 MCM	37	948.00	750 MCM	61	729.00	219.00	23%

Fig. 4. Specific work areas have been designated for servicing the trucks, such as electrical, gasoline engines, chassis, grease and oil, general, etc.

ELECTRIC TRUCKS AT CRANE

release, without replacement, of vehicles which would normally have been replaced at a cost of $65,000.

It became apparent early in the controlled maintenance inspection cycle that repairs made necessary because of vehicle abuse or accident would have to be reduced to a minimum if we were to maintain control. Several steps were taken to achieve this, and produced satisfactory results. Step No. 1 was the institution of a formal driver training program. Step No. 2 was the requirement of a special order signed by the head of the department to which the vehicle was assigned and a short note, containing the name and clock number of the operator, covering any mishandling or accident. The cost of such repairs were then charged against the special order and were reflected in the department's monthly budget. This procedure proved to be a remarkable curb to abuse of trucks.

How Costs Were Charged

Another reason for a separate method of charging such costs was that all normal repair costs were charged against the vehicle, which we expected to use to evaluate one manufacturer's product against the other. By including non-routine costs, we would get a distorted picture and defeat the purpose of our accounting procedure.

Another offshoot of the controlled maintenance system was the general rehabilitation of the repair floor area. The tire stockroom and the parts stockroom were taken out of the main work area. Dead stock, departmental tools and items such as bolts, nuts, washers, setscrews, cotter pins, etc., were removed from the stockroom area. The stock was rearranged according to like parts and stocked in standard wire stacking containers for portability.

The advantages of like-part stocking facilitated part standardization, allowed the use of similar containers or container supplements, immediately exposed parts that were out of place and by doing so narrowed the search area for missing or misfiled parts.

The portability feature allowed for expansion or contraction of the stockroom quickly and inexpensively. Upright tool cabinets were purchased and tools were placed in them on the repair floor in the area of most frequent use. Small common parts including bolts, nuts, washers, etc., were placed in open revolving stands at convenient areas on the repair floor.

Work areas were laid out for specialized work such as Area No. 1 "Gasoline Engines"—Area No. 2 "Electrical Parts" — Area No. 3 "Chassis" etc., see Fig. 4. A battery charger for each of the four different voltage batteries used was set up in the garage area and spare vehicles assigned there. This allowed a truck operator to bring in a vehicle needing repair and to pick up a spare vehicle and be back on the job with a minimum of lost time.

It became a smooth routine for a truck operator to bring a vehicle to the head mechanic who would register the time in, assign it to a repair area and assign a spare truck to the driver who would be on his way to the production floor without delay.

A word about results. The proof of the effectiveness of any program is evident in its end result. The $32,000 annual savings was realized in only eight months after the controlled maintenance system had completed its first cycle.

Expenditures for rehabilitating the garage areas, including battery chargers, stockroom containers, tool cabinets, etc., held the savings to that figure for the year. There is every reason to believe that with the same production figure the annual savings would amount to over $45,000. The $65,000 value of equipment which would normally have been replaced must be considered a one-time savings.

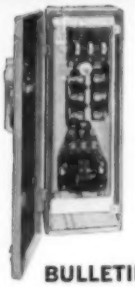
Result: Trucks in Top Shape

Coupled with this savings is the over-all excellent condition of our vehicles and the vastly improved service to production departments. This is being accomplished with a ratio of one person to each 16 vehicles or a better than 50 per cent improvement over our former figure and the figures from any comparable company as noted in the proposal.

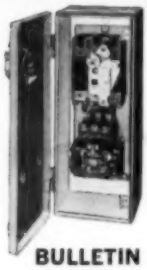
Another aspect of the program was that the personnel engaged in repairing vehicles were encouraged to take additional time and make sure that the vehicles they had worked on went back to their area freshly painted, if necessary, and in tiptop shape. As the equipment began to look better it became a matter of personal pride to turn out a good job, and it was not unusual to hear a mechanic berate a vehicle operator for the condition of his truck. Taking pride in the equipment has also been evident in an evergrowing number of truck operators. This is a result which in itself will insure the success of our controlled maintenance system.

For the benefit of the reader, we wish to repeat that this article revolves around our actual experiences at Crane Co. We sincerely feel that the basic essentials for a successful preventive maintenance program are contained herein, but that your particular requirements may dictate variations in the technical programming. **End**

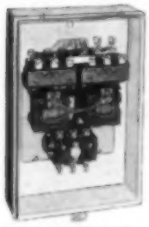
For more facts circle 568 on Reply Card →



BULLETIN 712
Size 1 combination starter with fused disconnect switch

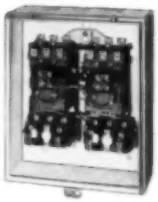


BULLETIN 713
Size 1 combination starter with circuit breaker

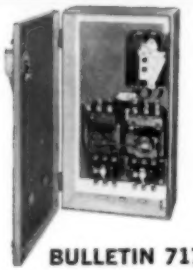


BULLETIN 705
Size 2 across-the-line reversing starter with overload relays

BULLETIN 706
Size 1 reversing starter with fused disconnect switch



BULLETIN 715
Size 1 across-the-line, multi-speed starter with overload relays



BULLETIN 717
Size 2 multi-speed starter with circuit breaker

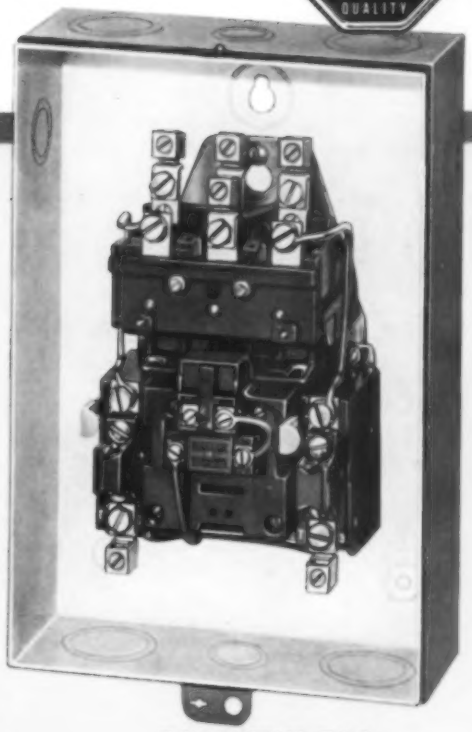
BULLETIN 702
Size 3 three-pole, a-c solenoid contactor

Pygmies in Size
Giants in Performance—
the NEW Allen-Bradley Across-the-Line Starters!

This new line of across-the-line motor starters is the result of over 30 years of experience and leadership in the motor control field.

While retaining the simple solenoid principle—with only ONE moving part—these starters are completely new in every way. They are amazingly small in size—yet test after test has proved they will not only outperform but also outlast any starter now on the market. They are good for *many millions* of trouble free operations. All have scores of design refinements that make them easier to install and maintain. All are available in the smart new enclosures designed by Brooks Stevens. They make a beautiful addition to any machine or control installation.

You'll want to get the complete story about these truly revolutionary new across-the-line starters. Write for new Publication 6100.



BULLETIN 709
This popular across-the-line solenoid starter shows the new Size 2 construction. Note the white interior and generous wiring space. Bulletin 709 starters are available, in the new construction, in seven sizes—Sizes 00 to 5, with a maximum rating of 100 hp, 220 v; 200 hp, 440-550 v.

ALLEN-BRADLEY

Member of NEMA

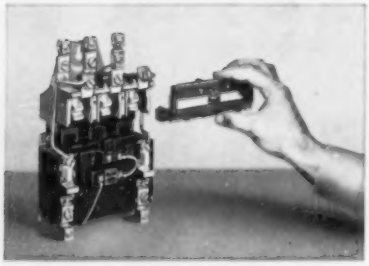
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

QUALITY MOTOR CONTROL

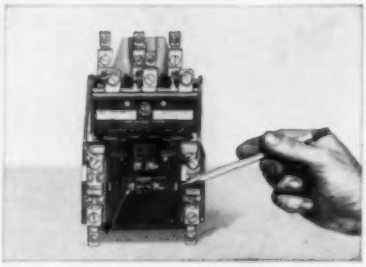
Features of the NEW Allen-Bradley starter line that are of value to you!

New Bulletin 709 Size 3 across-the-line motor starter. Note the generous space for wiring, accessible terminals, and white interior.

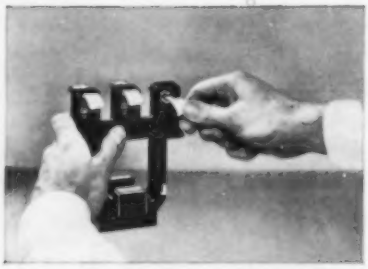
Every detail of the new Allen-Bradley motor starters has been designed to help make this the best line of motor control on the market. Remarkably small in size, each starter is a giant in performance. Being light in weight, these starters are easy to handle and a cinch to install. The generous wiring space, full front wiring, white interiors, and convenient knockouts make installation easy. The enclosure cover is firmly held with a quarter-turn fastener. All installation, inspection, and maintenance operations can be handled from the front—as shown in the illustrations below—without the use of special tools.



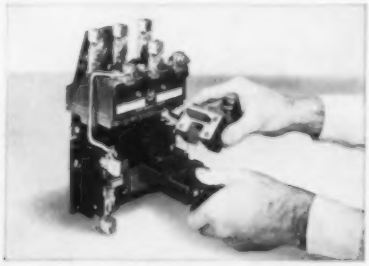
QUICK, EASY CONTACT INSPECTION—When the arc hood front cover is removed by loosening two captive screws, contacts are plainly visible from the front.



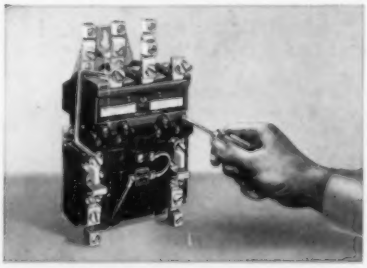
CONTACT POSITION INDICATED—Two slots in the coil cover show the position of the movable contact support—tell whether contacts are "closed" or "open."



CONTACTS EASILY REPLACED—Depress the spring slightly, and the movable contacts can be lifted out of the molded support and the new contacts slipped in.



COIL EASILY CHANGED—When the coil cover is removed, coil and magnet yoke can be lifted out from the front. They are impossible to replace incorrectly.



AUXILIARY CONTACTS EASILY ADDED to the front of the starter. Two extra auxiliaries can be added to Sizes 0, 1, and 2 starters, and four, to Sizes 3, 4, and 5.

A THIRD OVERLOAD RELAY CAN BE EASILY ADDED in the field, from the front of the starter. And the only tool needed is a common screwdriver.

ALLEN-BRADLEY

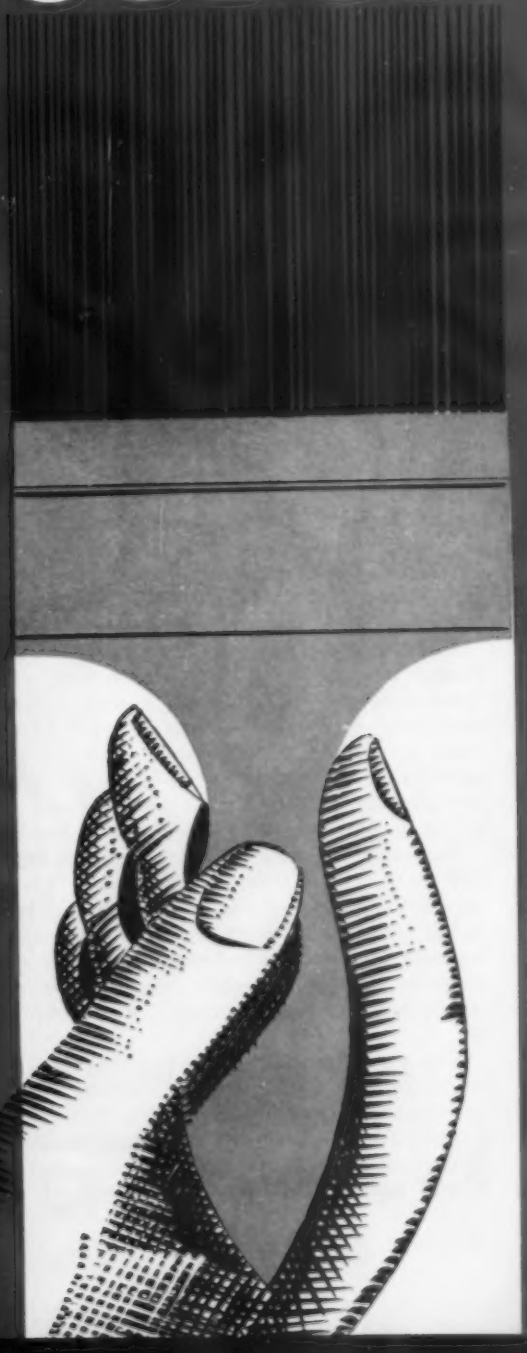
Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

QUALITY MOTOR CONTROL

NOT WET PAINT

IT'S WET COPON



And long after there would be need for *more* wet paint, this Copon coating will be giving protection against corrosion. That's why it's used instead of paint to protect so many "tough spots".

Copon looks like paint, sure. You can brush or spray it on. Even roll it on. But indoors or out, it *stays* on so much longer than paint.

Where are Copon epoxy coatings used? On metal, wood or concrete surfaces. On areas exposed to excessive heat, fumes, salt or fresh water, or chemical spillage. On ventilation hoods, cooling towers, tanks, air washers, floors, piping, heat exchangers, production equipment.

Copon coatings *should* be used wherever you need persistent protection. Won't you call your nearest Copon Associate and let him give you plenty of reasons why? He'll help you choose the color and type of Copon Coating best suited to your problem. And there's no obligation, of course.

FOR CORROSION CONTROL

Copon®

Copon Associates:
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Buffalo/McDougall-Butler Co.
Chicago/Enterprise Paint Mfg. Co.
Houston/Coast Paint & Lacquer Co.
Los Angeles/Walter N. Brenan Co., Reliance Varnish Co.
Louisville/Reliance Varnish Co.
Oakland/Walter N. Brenan Co.
Pittsburgh/James B. Sips & Co.
Roanoke/Southern Varnish Co.
London, Eng./E. Wood Ltd.
Mexico, D. F./Anticorrosivos, S. A.
Vitry-Sur-Seine, France/Copon France Division de Pyrolac
Victoria, B. C./British American Paint Co.

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Fig. 1. Editors and others gathered in room where data processing equipment is located and qualified personnel was on hand for some comments.

NUMERICAL CONTROL COURSE GIVEN BY BOEING

INDUSTRIAL MAGAZINE editors recently attended "school" at the Boeing Airplane Company plant in Wichita, Kansas. Among the "students" taking a short course on numerical control was E. B. Skubik, Engineering Editor of PLANT ENGINEERING magazine.

Teaching this subject is nothing new to Boeing personnel who have given courses to thousands of people on various facets of numerical control. Training is one of the functions of a special group at Boeing called BACS (Boeing Applied Computing Services). In this course, Jack Moorhead of BACS and Floyd Bledsoe, a Boeing instructor, handled lectures and discussions.

With the use of a dimensional drawing, these students became familiar with manual programming operations. These dealt with the setting up of machine instructions for point-to-point machining using a base reference point called home position. Manual programming was compared to the computer assist method, which repeats certain operations, and as a result greatly reduces the number of programmed steps required to do the job.

Perforated and magnetic tapes were discussed along with ways in which they are signal coded. The students were also given a brief description of how the tape coded signals bring about machine operations. In the control approach that was touched upon, signals are essentially compared to standard signals from a reference channel on the magnetic tape, resulting in desired tool positioning.

Binary numbers were also discussed in the course. An interesting way of decoding such numbers to common Arabic numbers was illustrated. This is identified as the "Double-Dabble" method in which manipulations involve adding and doubling of various sums obtained until the number represented by the digits is obtained.

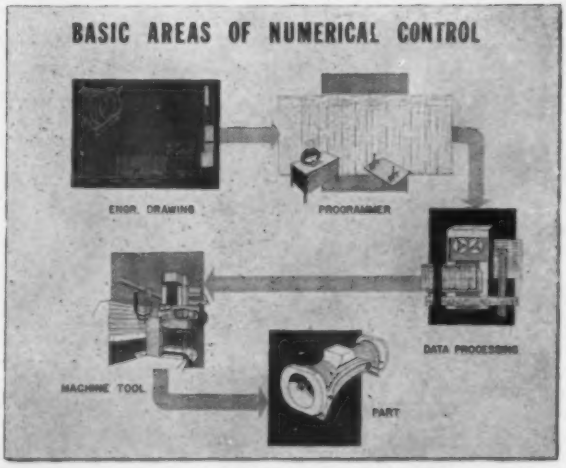

Fig. 2. Illustrations relate to the facets of numerical control which were considered in the course. These were reproduced from a copy of manuals used in a course for American Machine Tool Distributor's Association.

Comments on advantages of numerically-controlled machine tools by one of the lecturers brought about remarks from the audience regarding a "proof-of-the-pudding" experience with numerically-controlled equipment. In one plant a numerically-controlled machine replaced nine machines. Stock inventory was reduced and the approximate number of parts that previously took about four months to produce required about one month with numerical controls.

It was pointed out that tape control is not a cure-all. However, a couple of attractive features of tape are that it can be used advantageously for short run production, and that it can be easily changed.

At the end of the course the group was escorted through the plant to areas where numerically-controlled machines were in operation. **End**

Quality metal products deserve
"the finishing touch" of Mahon

another example . . . 'maximum protection' cargo drums from top U. S. supplier

Mahon's metal cleaning and rust-inhibiting line installed at the Port Arthur, Texas, plant of a major supplier assures a "100% scale-free" product. Complete finishing is after fabrication to provide the best in cargo drums.

Mahon's Industrial Equipment Division knows production finishing best. If you make cosmetic cases or appliances, bicycles or railroad cars, or any other metal product . . . and if quality comes first . . . call in Mahon. Improved finishing can be the easiest and most economical product improvement you'll ever make. New paints, new methods broaden the possibilities. Find out what the 'finishing touch' of Mahon can do with your products . . . your costs . . . your sales. Get in 'touch' with Mahon.

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MANUFACTURING PLANTS—
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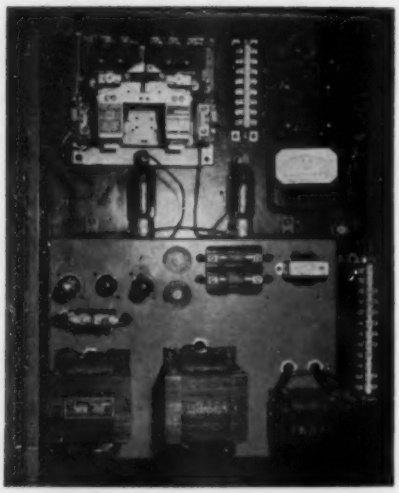

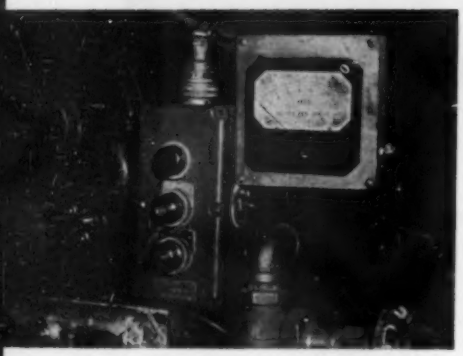

Fig. 1. After removing mechanical control mechanism, an a-c tachometer generator was coupled to motor shaft.

Fig. 2. All electrical and electronic components are placed in enclosure which is mounted on rear of grinder.

Fig. 3. Control station, consisting of on-off switch, and pushbutton for dresser motor is located on grinder.

Build Your Own

ELECTRONIC SPEED CONTROL

By C. R. **WHEELER**, Plant Engineer, The Monarch Machine Tool Co., Sidney, Ohio

PLANT ENGINEERS must be constantly on the alert for opportunities to reduce maintenance costs. In some cases, modernizing an operation to take advantage of new techniques can result in substantial savings in repair costs.

An example of this kind of cost reduction work is the application of an electronic speed control on a surface grinder form wheel dresser mechanism. The original drive on these dressers used a series wound universal motor operating on 115-v, 100 watts, and with a speed range of 500 to 7500 rpm.

Speed control was accomplished by a pulsing mechanical speed control mechanism controlled by a dial on the end of the motor. Maintenancewise, these motors proved very expensive. We stocked six spare motors for three surface grinders. Usually two motors at a time were sent back to the manufacturer for repair and each time the fault was in the mechanical speed control mechanism.

To eliminate this continuous maintenance problem, we designed, built and installed an electronic speed control unit on each of the three surface grinders. The original mechanical speed control mechanism was removed from the end of the drive motor and an a-c tachometer generator was coupled to the motor shaft, Fig. 1. With an output of 0.005 volt per rpm, this tachometer generator operates two speed indicating meters and also furnishes a signal reference voltage. This reference voltage is applied to the electronic rectifier control tube to maintain constant speed.

All the required electrical and electronic components are mounted in a sheet metal enclosure, Fig. 2, mounted on the rear of the grinder. The operator's control station, Fig. 3, is located on the grinder and consists of an on-off switch for the power unit, a pushbutton to start the dresser motor and a meter calibrated in "inches per minute." This meter tells the operator the speed of the dressing diamonds across the form wheel and also informs him of any erratic operation of the unit.

In the control circuit, Fig. 4, turning the selector switch to the "on" position energizes contactor M. When the operator presses the "start" pushbutton, a circuit is completed through the normally closed forward limit switch to the forward contactor F. Contacts F in the motor circuit close and the dressing tool moves across the grinding wheel. Auxiliary contact F maintains the circuit.

At the end of the pass the forward

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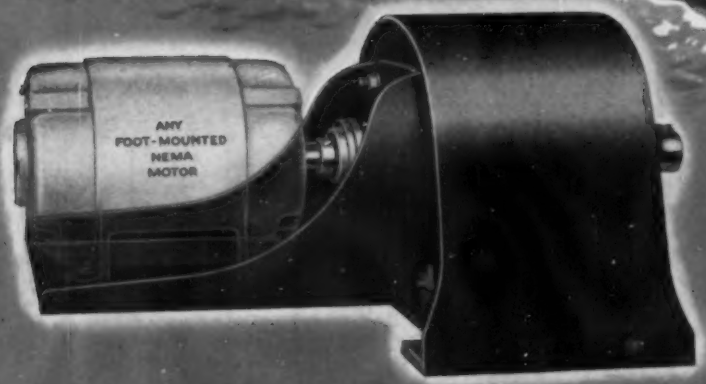

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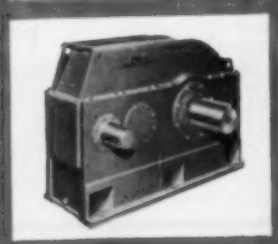

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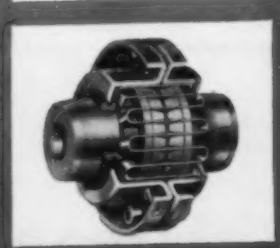

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ELECTRONIC SPEED CONTROL

limit switch is operated, transferring the circuit to the reverse contactor R. Contacts R close, reversing the dresser motor. The reverse circuit is maintained through the normally closed reverse limit switch until the dresser reaches the starting position. At this point the reverse limit switch is operated, dropping out the R contactor. The cycle can be repeated by again pressing the "start" pushbutton.

Direct current is supplied to the dresser motor from a conventional single phase fullwave electronic rectifier circuit using two EL-C3J grid controlled thyratrons, Fig. 5. The 6H6 and 6N7 control tubes operate back-to-back to shift the level of the d-c bias on the grids of the EL-C3J thyratrons, developed across the 1.0 mfd capacitors. The 10,000 ohm potentiometer used for speed control adjustment varies the bias on the grid of the 6N7 control tube.

Feedback is supplied by the a-c tachometer generator driven from the motor shaft. This a-c signal is rectified by the 6X5 full wave rectifier tube. The d-c output is filtered and then applied to the grid of the 6N7 as a reference voltage which is proportional to the dresser drive motor speed.

Compensation potentiometer, R-3, acts as a voltage divider to obtain the proper compensation voltage which is also applied to the grid of the 6N7. With this circuit, any change in motor speed due to load changes the bias voltage on the 6N7 control tube and thus the d-c output voltage to the motor. Speed regulation is held to about seven per cent of the set condition.

Since the installation of this electronic speed control to replace the troublesome mechanical speed controls, we have had no motor failures and machine downtime due to dresser faults has been cut to the barest minimum. **End**

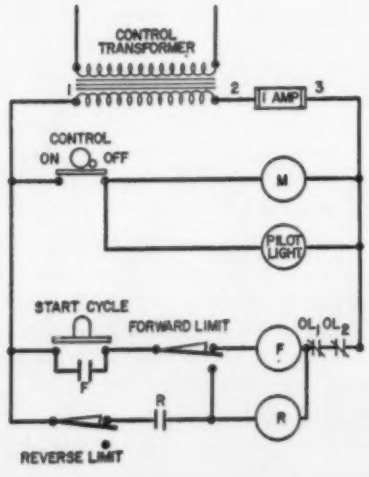

Fig. 4. Details of the circuitry which is employed in controlling movements of tool across the grinding wheel.

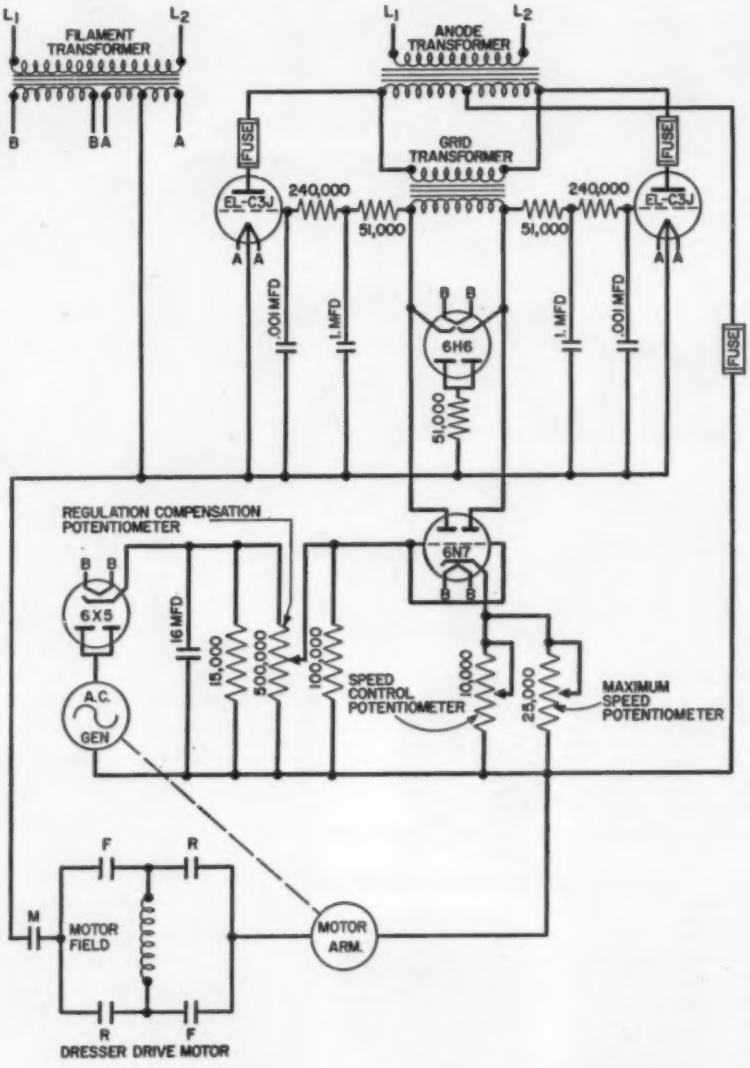

Fig. 5. To supply direct current to the dresser motor, we are using a conventional electronic rectifier circuit.

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Interior Vitro-Tech Corp.

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Abrasive Blast Descales Continuous Steel Strip in New Machine

THE LARGEST and most powerful blast descaling machine in the world, capable of processing an average of 120 tons per hour of continuous steel coils, is in operation at Empire-Reeves Steel Corp., Mansfield, Ohio.

Completely automatic with a central pushbutton control panel, the 60-ft-long machine prepares hot-rolled carbon and silicon strip for cold rolling. The strip is used in automotive, electrical and galvanizing applications. Designed and built by Pangborn Corp., the installation will accommodate any strip between 24 and 50 in. wide.

Composed of three integral blast cabinets to simplify abrasive handling, the unit hurls 660 tons of abrasive per hour of blasting. Twelve Rotoblast wheels (totaling 900 hp) cover both sides of the strip simultaneously—six blasting downward, six upward. Each of the three cabinets contains a separate abrasive cleaning and recycling system. This includes two double-capacity elevators and two air-wash separators, feeding a single abrasive storage bin which supplies four Rotoblasts.

Each pair of blast units (upper and lower) is adjustable, and may be removed for maintenance without stopping the machine or requiring a man to enter the cabinet. These and other features provide a completely fail-safe operation and allow a continuous flow of strip through the unit.

Lightweight Insulating Doors Have Foamed-in-Place Plastic Foam Core

PLASTIC DOORS provide reliable insulation, light-weight operation, cleanliness, durability and color compatibility for controlled-temperature rooms at the new Pfizer Medical Research Laboratories in Groton, Connecticut.

The doors, made by the Jamison Cold Storage Door Co., of Hagerstown, Md., insure the close control of room temperatures necessary for proper growth and storage of the mold and fungi cultures. The doors make it possible to keep room temperatures within a half degree Centigrade of desired levels such as 4 C (38 F) for storage and 26 C, 32 C, and 37 C for incubation rooms.

Foamed-in-place polyurethane plastic, inside the doors, has excellent insulating capacity. The plastic doors weigh only about 90 pounds, in contrast with more conventional metal-clad insulating doors which may weigh up to 450 pounds. All exposed surfaces are made of glass-reinforced polyester plastic, which resists chemical attack and corrosion.

Hermetic sealing guards against bacteria growth in fissures and seams, or inside the doors. Thus the doors are compatible with the sterile conditions essential to avoid contamination of experimental cultures.

Pfizer chose doors of two colors—battleship gray and seafoam green—from among a variety of colors in which the insulating doors are made.

Steam Generators To Ultimately Power World's Largest Nuclear Power Plant

THE FIRST of ten steam generators to service the Atomic Energy Commission's New Production Reactor at Hanford Works, Richland, Washington, has been completed by Combustion Engineering, Inc. When the steam produced by these generators is used to serve a proposed generating facility, to have a capacity of 700,000 kw, Hanford will be, by far, the largest nuclear power plant in the world. Power produced will be one-third more than the output of the Bonneville Dam. The generators will produce steam with heat from cooling water issuing from the Hanford plutonium-making plant.

Each of the steam generators is ten feet in diameter, 57 ft long, with a shipping weight of nearly 170 tons. About 20 miles of stainless steel tubing are used in each generator—stainless steel, because the radioactive environment requires high corrosion resistance and maximum reliability.

The unique steam generators, completely shop-assembled, welded units, are cylindrical vessels with elliptical heads (with 16-in. manways). These pressure vessels contain both steam generating and the steam separating equipment.

Problem: Lack of pep -- and people -- due to bad air

This plant needs make-up air! If production is off because your workers lack pep or become sick from bad air, check your exhaust system! Its fans may be removing air faster than you replace it. This causes a vacuum that can put your plant ventilation dangerously out of balance. Your plant needs make-up air...a supply of new air to replace exhausted air.

Without make-up air, the vacuum can cause down drafts in combustion flues and exhaust hoods, exposing workers to carbon monoxide and other dangerous fumes. Vitality sags. Absenteeism rises. Production drops.

Solution: install a make-up air system -- fans to bring in fresh outside air, and heaters to temper it. You cancel out the vacuum, ease the load on exhaust fans and the regular heating system. No ventilation plan is complete without make-up air.

For technical help on make-up air, see your Consulting Engineer. Or call in Sturtevant application engineers. They're experts in handling air...whether you want to move it, heat, cool or clean it. J-90710

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INDUSTRIAL PLANT CONSTRUCTION.— information on location, costs

Azusa, Calif.—Aerojet-General Corporation plans to construct a plant here for the manufacture of infrared subsystems for the Air Force Midas satellite under a subcontract from Lockheed Aircraft Corp. The new facility will cover 30,000 sq ft—24,000 sq ft of which will be devoted to a dust free, airtight room in which the delicate components will be manufactured, assembled and tested. Plant will cost approximately $1.3 million.

Mojave, Calif.—United Carbon Company, Texas Eastern Building, Houston, Texas, plans to construct a carbon black plant on a 45-acre site recently acquired for the purpose. Company has awarded contract to the Lummus Company, 2707 Wesleyan St., Houston, Texas, for the design and construction of the one-story structure which will be built along Highway 6 and the Southern Pacific Railroad. Plant will be completed in 1962.

Riverside, Calif.—Dow Jones & Company, Inc., 44 Broad St., New York, N. Y., plans to construct a Wall Street Journal publishing plant on a building site of approximately 22 acres in this city, 60 miles east of Los Angeles. Plant will be equipped with the latest developments in automated machinery.

San Jose, Calif.—International Business Machines Corp., 590 Madison Ave., New York, N. Y. plans to construct a product development laboratory. Plans call for the erection of a two-story building with a floor area of 154,000 sq ft. Laboratory is scheduled for completion early in 1962 at a cost of about $2 million. John Bolles, San Francisco, Calif., is the architect.

Selma, Calif.—Sun Maid Raisin Growers of California, 2902 E. Hamilton Ave., Fresno, Calif., plan to construct a raisin processing plant on large site located here. New facility will be erected on Highway 99 at a cost exceeding $3 million, under plans of Wagner & Partners, Fresno, Calif. Work on the new facility will start soon for completion by 1962.

Claymont, Del.—Air Reduction Co., 150 E. 42nd St., New York, N. Y., will start construction soon on a large air separation facility here to serve the petrochemical industry. The plant, to cost about $5 million when completed, will be erected adjacent to and serving SunOlin Chemical Company's new ethylene and ethylene oxide plants. Plant will be completed by the end of the fourth quarter of this year and will begin piping oxygen directly to the SunOlin facilities.

Wilmington, Del.—Atlas Powder Company, New Murphy Road, this city, plans to construct a large plant at Atlas Point, near here, for the production of glycerin and related polyol chemicals. Construction of the new unit will begin soon for completion by the summer of 1962. The new plant will be integrated with sorbitol, mannitol and other polyol operations at this location. Company will invest $17 million in the facility which includes expansion and improvement of the site.

Atlanta, Ga.—The Southern Cement Company, Protective Life Building, Birmingham, Ala., plans to construct a cement plant on tract of land just outside this city. Company, a division of American-Marietta Company, plans to begin construction of the unit this summer. New plant which will have an initial capacity of 1,500,000 to 3,000,000 bbl a year will be completed early in 1963.

Anderson, Ind.—Delco-Remy Division of General Motors Corp. plans to construct an engineering and research center at its plant located here. The new building with a floor area of 225,000 sq ft will include automotive electric product engineering activities for commercial and military products, as well as test engineering and research and development laboratories. Work on the new facility will get under way soon at an estimated cost of about $8 million. The unit will be completed late in 1962.

Baton Rouge, La.—Kaiser Aluminum & Chemical Corporation, 1924 Broadway, Oakland, Calif., plans to construct an addition to company's plant located here for the manufacture of tabular alumina. It is expected that the new addition will increase Kaiser's capacity to produce the product fivefold.

Sparrows Point, Md.—Bethlehem Steel Co., Bethlehem, Pa., and Allied Chemical Corp., New York, N. Y., have announced plans to build, jointly, a large tar distillation plant at Bethlehem's facilities here. The plant will recover chemicals from coke oven tar for processing in Allied Chemical's facilities at Philadelphia. The distillation plant will have a capacity to process more than 50 million gallons of tar annually into a chemical containing crude napthalene in quantities estimated in excess of 42 million lb a year.

Ecores, Mich.—Detroit Steel Corporation, 1025 S. Oakwood St., Detroit, Mich., has awarded a contract in the amount of $1 million to the E. W. Bliss Company, 250 Franklin St., Salem, O., for the installation of a high-temper mill along with coil conveying equipment. Work will begin soon for completion by 1962.

Montague, Mich.—E. I. du Pont de Nemours and Co., Inc., Wilmington, Del., has developed a process to make acetylene from low-cost hydrocarbons and announced that it would build a multi-million dollar plant at this location to manufacture upward of 50 million lb of the gas annually. New facility will supply a neoprene plant already in operation at this location, and will make the gas by cracking natural gas or petroleum by-products with an electric arc. Acetylene is present in varying quantities in these raw materials. Work on the new facility will get under way soon and is scheduled for completion early in 1963.

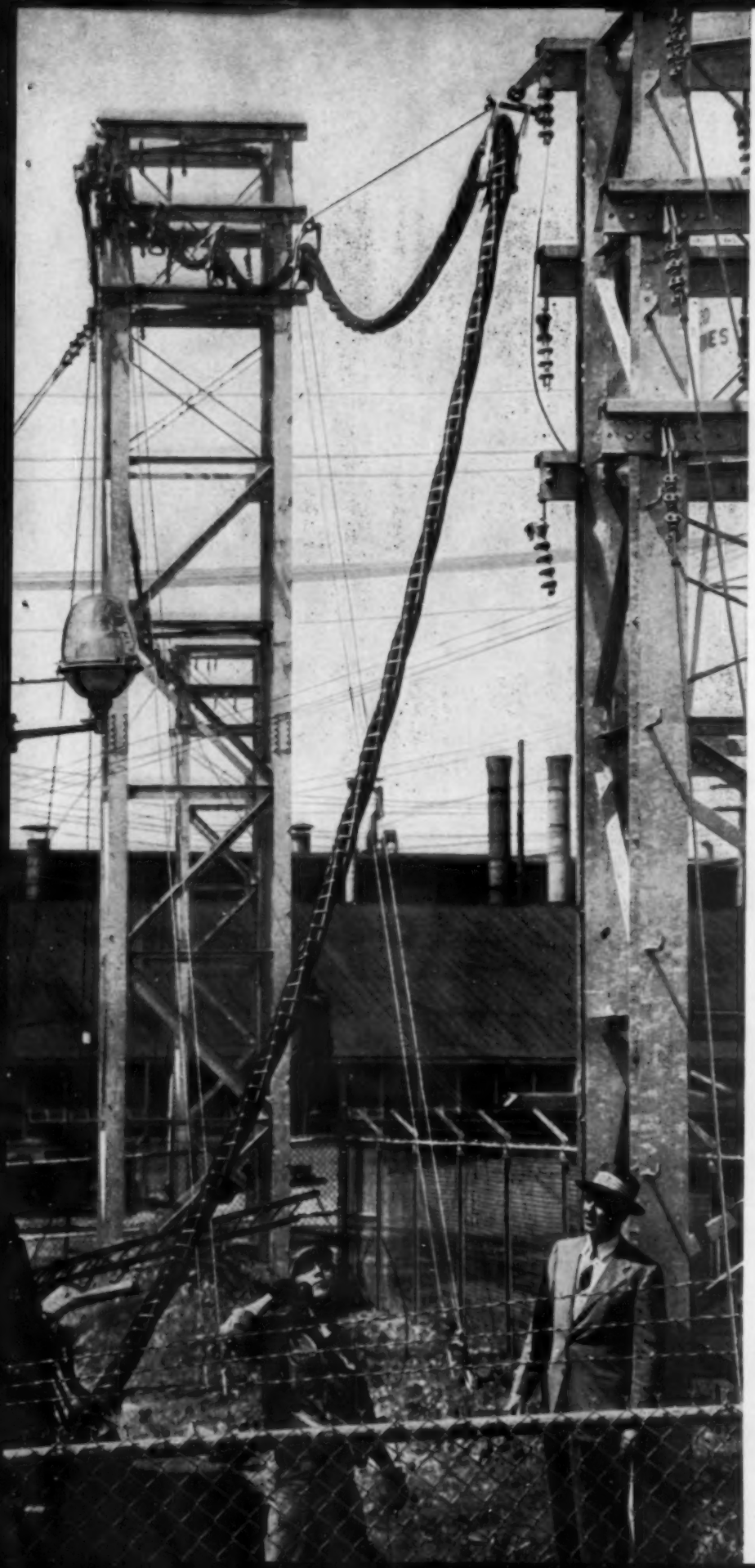
Moss Point, Miss.—International Paper Company's Southern Kraft Division, Mobile, Ala., has announced plans for a major expansion and improvement program at company's kraft division located here. Work will begin soon on new buildings and equipment installations at a cost estimated in excess of $3.5 million. Plants and installation of equipment will be completed in the spring of 1962.

Lincoln, Neb.—Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, O., plans a five-year, $2-million expansion program at company's Lincoln, Neb., plant. The first step in this planned expansion will be the construction of a warehouse building which will be pressurized to protect finished products from dust and dirt. This unit to be completed in the spring of 1962 will cost an estimated $400,000. Other work will be projected over a period to be completed in 1965.

Jersey City, N. J.—Owens-Illinois Glass Company, Ohio Building, Toledo, O., plans to construct a plant here for the manufacture of blown plastic bottles. Construction of a one-story concrete and steel structure with a floor area of 160,000 sq ft is already under way and is scheduled for completion late this summer. Contract has been awarded to the Lawrence Construction Co., of Springfield, N. J. Cost of the facility is reported to be about $2 million.

Princeton, N. J.—Radio Corp. of America, 30 Rockefeller Plaza, New York 20, N. Y. plans to construct a multimillion dollar space vehicle center for pre-flight testing on large site here. Work on the new eight-story building will get under way soon and is scheduled to start operations early in 1962. The pre-flight testing facilities in the center will include a kettle-shaped vacuum chamber about 32 ft

(Continued on page 212)



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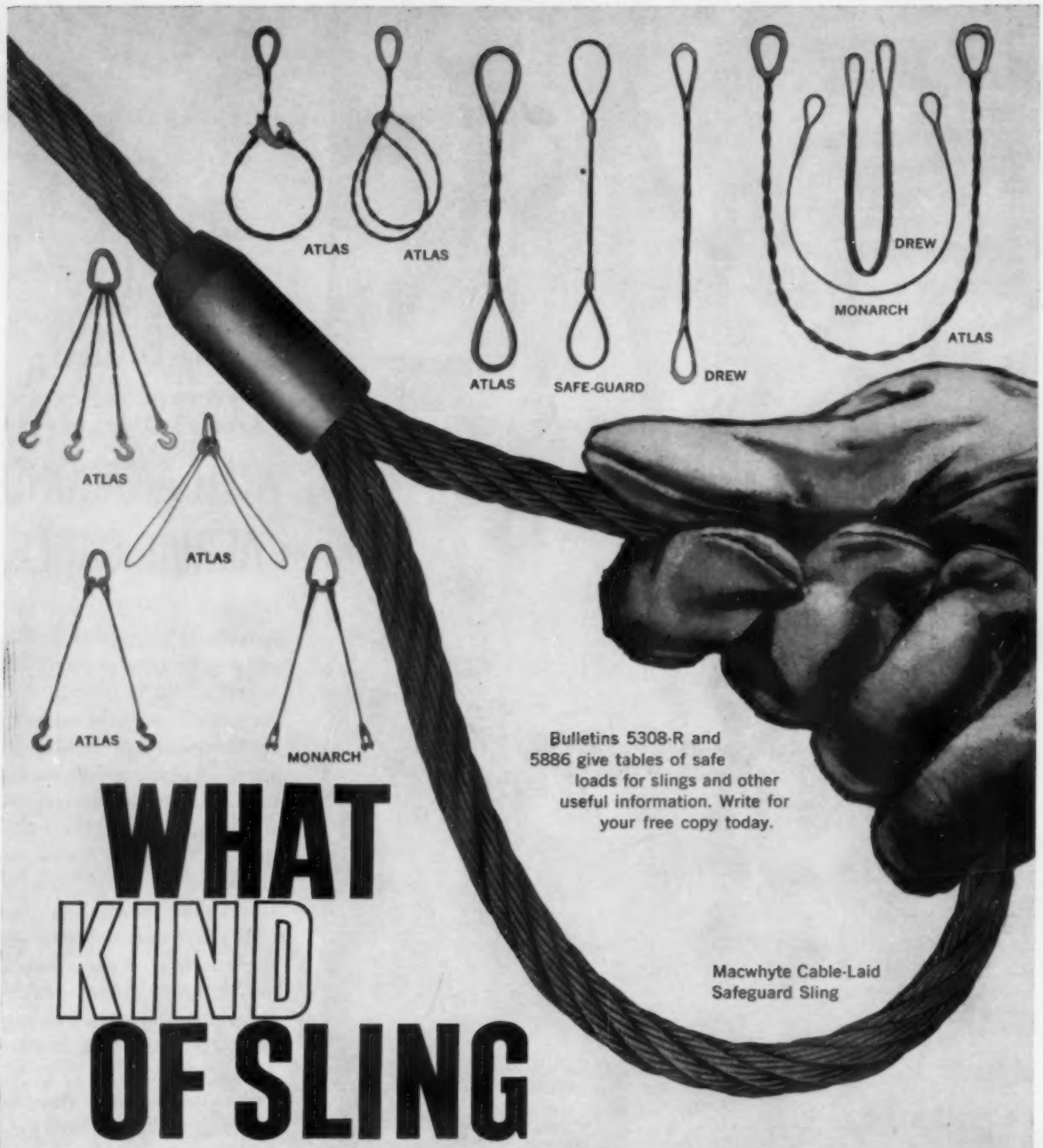

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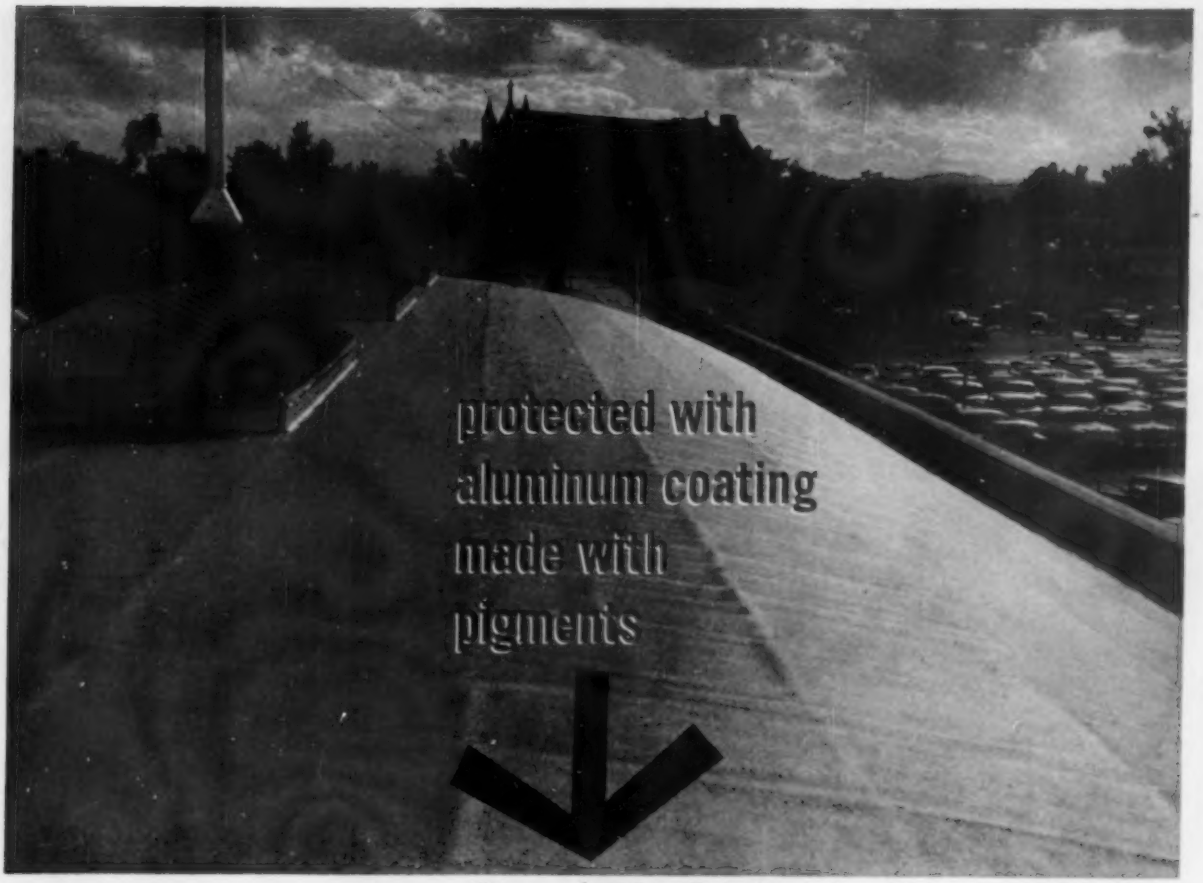

from ALCOA

User reports 20 years of trouble-free service with SILVERCOOL ALUMINUM ROOF COATING

For more than 20 years, Murphy-Mahoney Chevrolet Co., Denver, Colo., has protected its roofs with an aluminum coating, made by Asphalt Products Co., Denver, who call their product SILVERCOOL ALUMINUM COATING.

About results, W. D. Mahoney, general manager, writes, "We have re-treated with Silvercool every 5 years, and have had 20 years of trouble-free service. Inside temperature during the summer months has been cut many degrees, and the appearance of the building has been enhanced. Our roofer informs us that the condition of the roofing under the Silvercool is such that we can expect many more years of service from this roof."

You can get the same economical protection for your plant. Ask for an aluminum roof coating like Silvercool, which combines ALCOA® Pigments in a tough asphalt base. When applied, the aluminum flakes "leaf," forming a reflective surface that protects the vital oils from the sun; keeps the coating pliant and waterproof; reduces inside temperatures. Improved appearance alone is worth the modest investment.

ALCOA does not make roof coatings, but we'll be happy to refer you to reputable people who do. Please send the coupon for our informative booklets.

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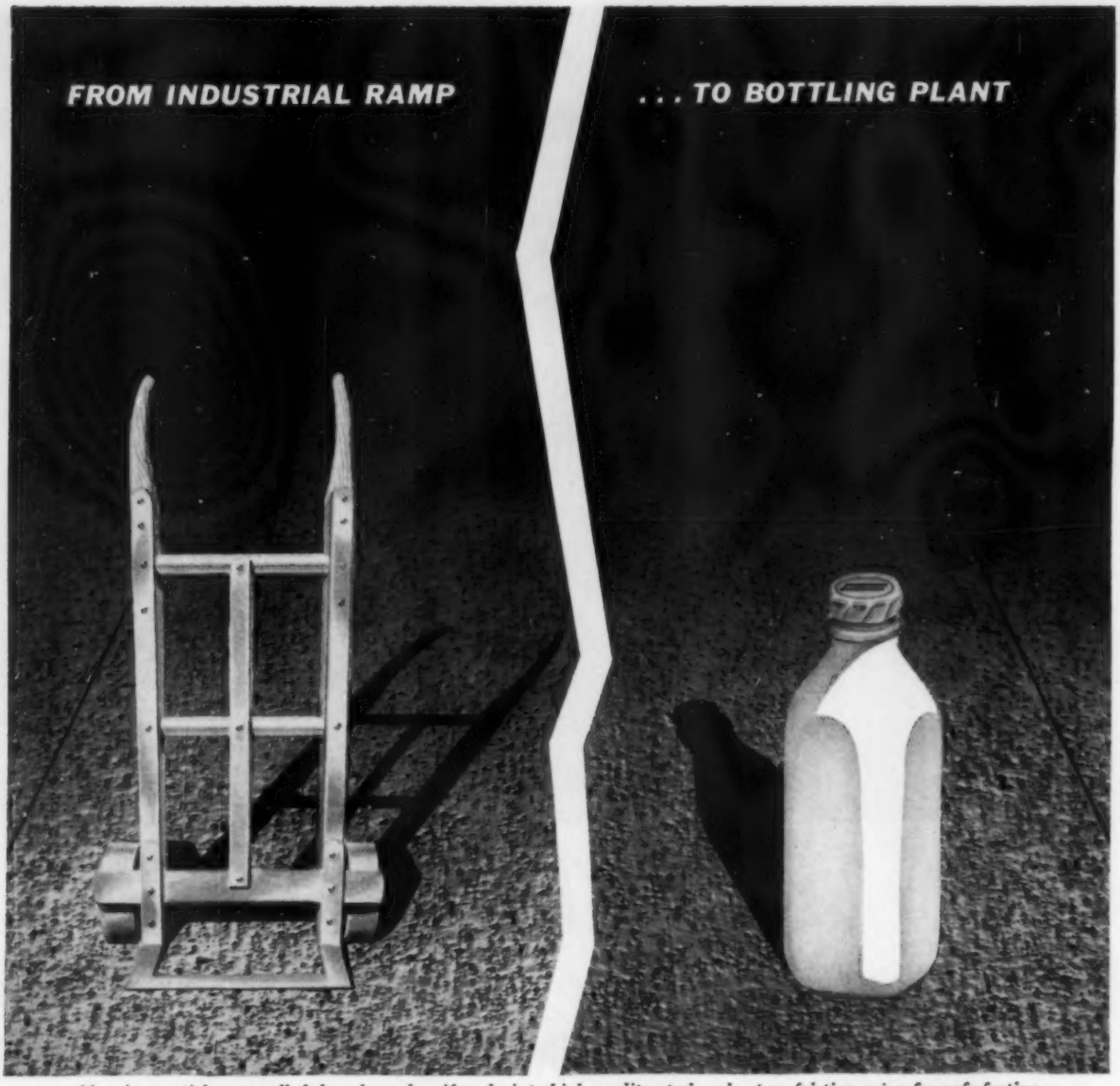

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Designed and built by McKiernan-Terry for Eastern Gas & Fuel Associates at Everett, Massachusetts, this Clark-controlled unloading tower incorporates an unusual automatic dumping cycle. Completely automatic control governs all operations beyond the vision of the operator.

We gave a magic brain to this unloading tower

Building electrical controls to meet special requirements is a job for which Clark engineers are exceptionally well qualified. The Clark control system for this unloading tower, for example, features an automatic dumping cycle that is surer, smoother and faster than even the most skilled operator.

From his extendable cab overlooking the ship's hold, the operator fills the bucket and brings it up and back to the tower columns. The dumping cycle then becomes automatic and all motions are precisely controlled by Clark's unique "adjustable-in-motion" rotating cam limit switch. Trolley travel and bucket dumping are perfectly synchronized. The "plug" always is at the proper instant, followed by immediate return of the bucket to the front columns. Unloading becomes a continuous, flowing operation. A high free-digging rate is maintained with ease.

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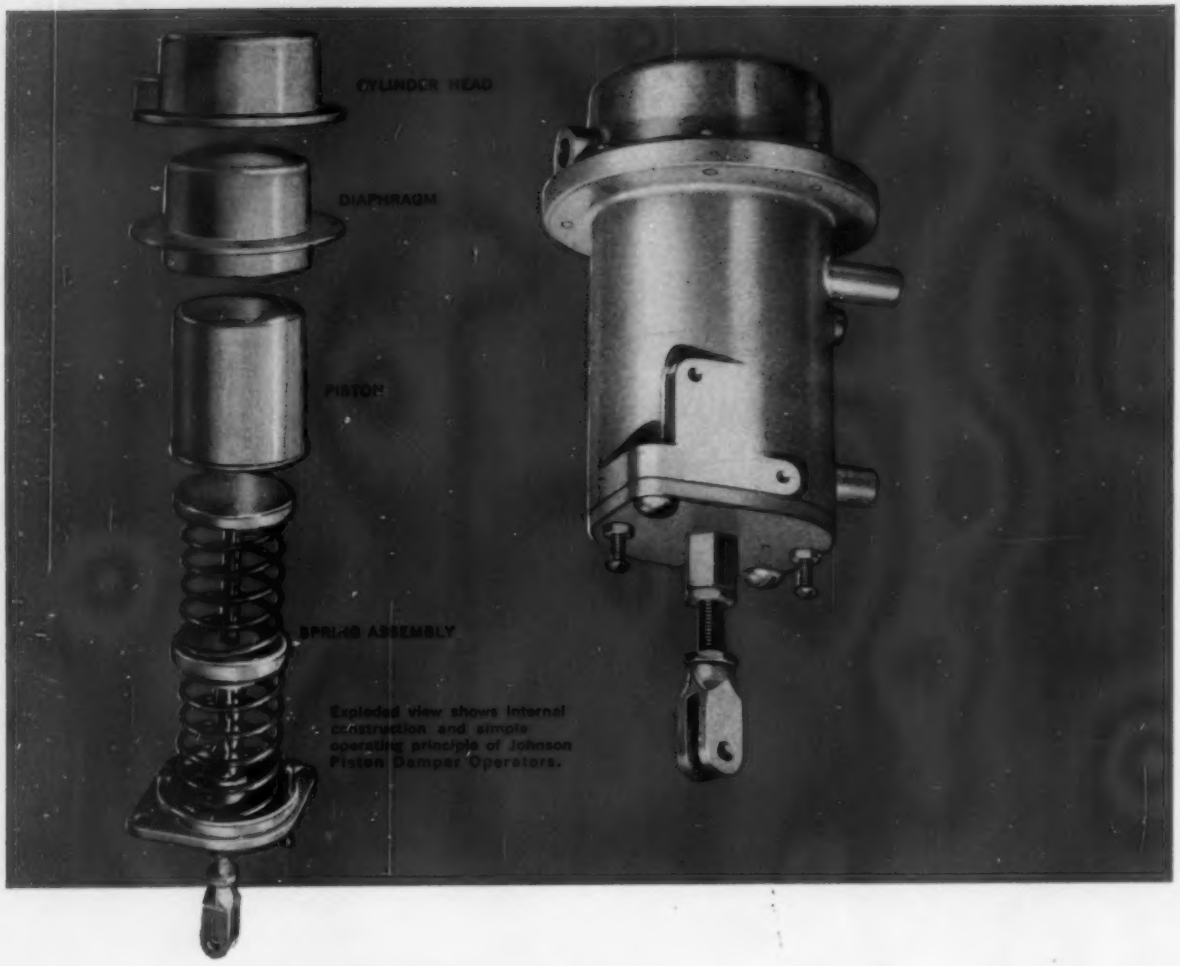
THE CLARK CONTROLLER COMPANY

MAIN PLANT: CLEVELAND, 10 • WESTERN PLANT: LOS ANGELES, 58
IN CANADA: CANADIAN CONTROLLERS, LIMITED, TORONTO, ONT.

For more facts circle 578 on Reply Card


CYLINDER HEAD
DIAPHRAGM
PISTON
SPRING ASSEMBLY
Exploded view shows internal construction and simple operating principle of Johnson Piston Damper Operators.

JOHNSON piston type damper operator

Simplified Design Assures Accurate, Trouble-Free Damper Operation

- Long stroke design for maximum power . . . allows damper to be operated *directly* from piston rod for accurate, positive positioning. No linkage or levers to lessen power. Easily outperforms conventional operators.
- Rugged, trouble-free construction. Spring and diaphragm are fully enclosed. Powered by age- and heat-resistant molded rubber or molded silicone diaphragms.
- Adjustable stops permit limiting stroke in either direction.
- Can be mounted in any position on damper frame, wall, or duct.
- Attractive die-cast, non-corrosive body.
- Available in choice of sizes and in single and two-stage models. Also available with Pilot Positioners for extreme accuracy of re-positioning.

For complete information, write for Bulletin D-251. Johnson Service Company, Milwaukee 1, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

For more facts circle 579 on Reply Card

Look for the label that assures weather resistance... high strength...pleasing appearance

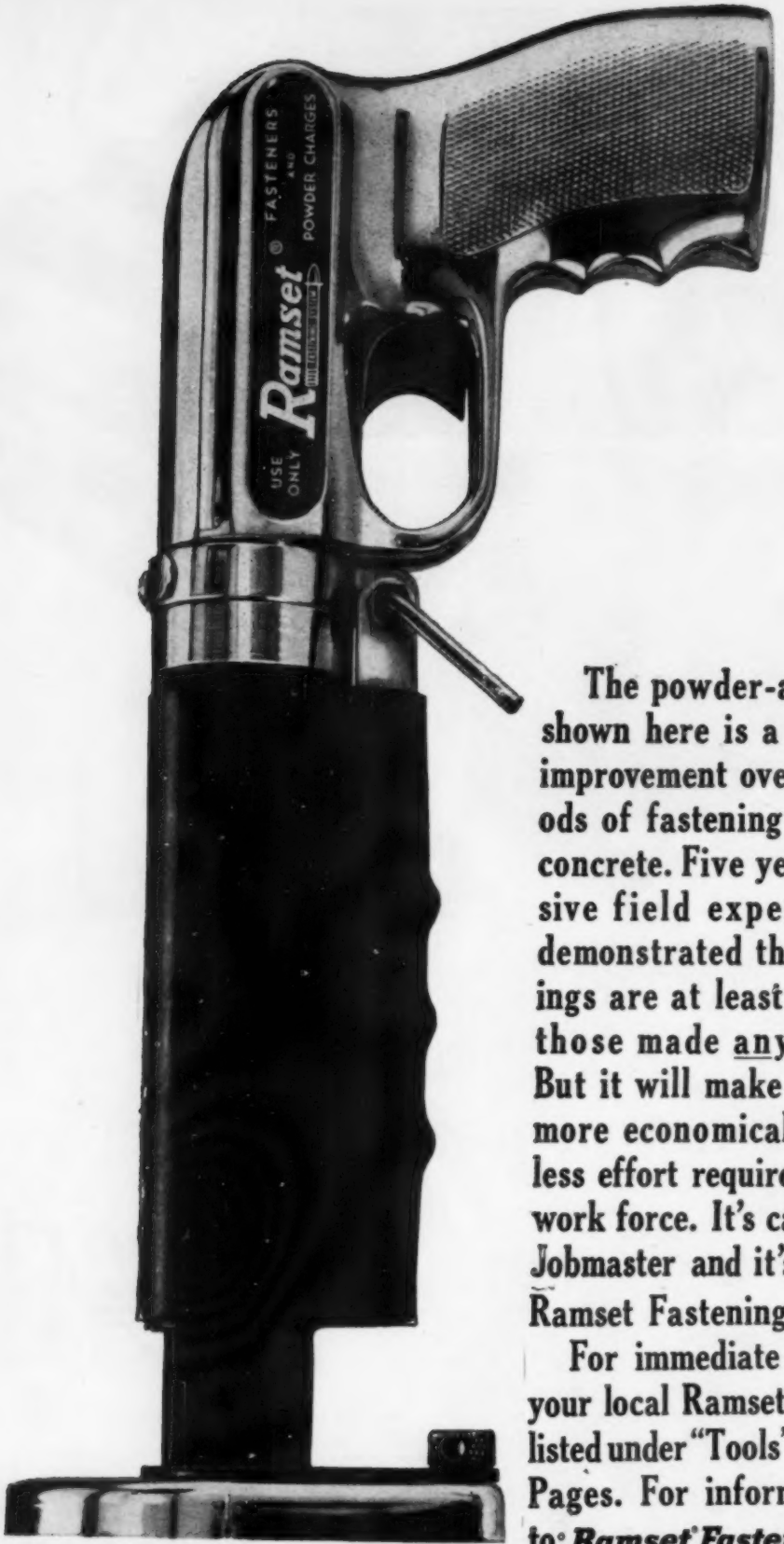
This label on a glass-fiber reinforced panel is your assurance of *unmatched weatherability*. It appears only on panels made with PARAPLEX P-444 acrylic-polyester resin. Extensive laboratory and field tests have proved that the proper combination of acrylic and polyester resins produces the *best* weather resistance in reinforced panels. This combination is found only in PARAPLEX P-444, made by Rohm & Haas. The resin also imparts pleasing appearance, high strength, excellent light transmission, and ease of installation. Write for the names of panel manufacturers who use PARAPLEX P-444.

ROHM & HAAS
PHILADELPHIA 5, PA.

PARAPLEX is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.

PARAPLEX P-444

For more facts circle 580 on Reply Card



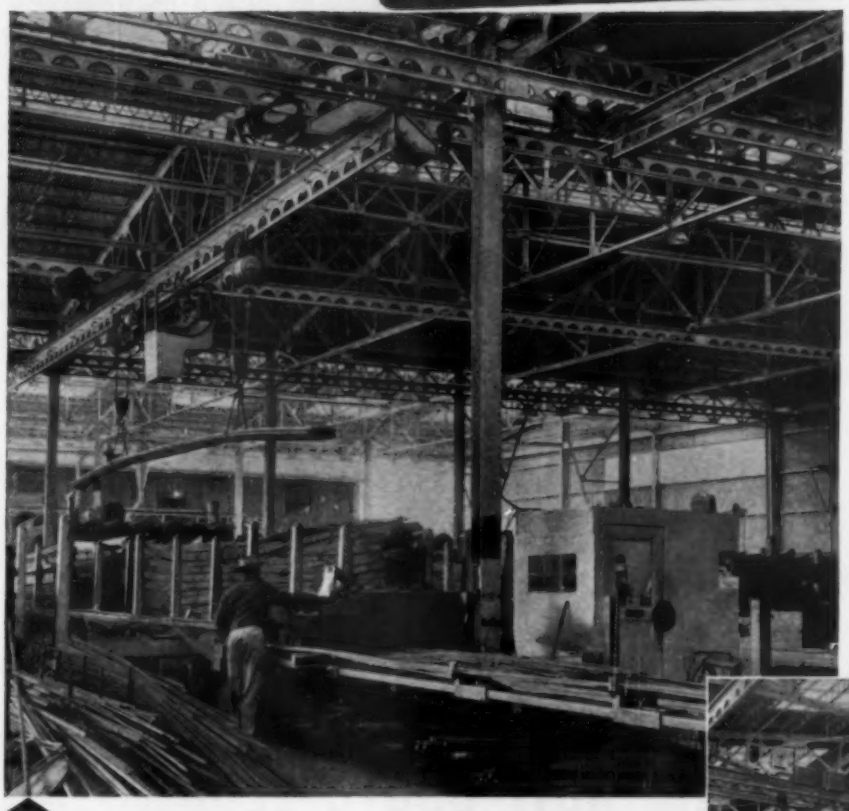
The powder-actuated tool shown here is a fundamental improvement over other methods of fastening to steel and concrete. Five years of extensive field experience have demonstrated that its fastenings are at least the equal of those made any other way. But it will make them faster, more economically, and with less effort required from your work force. It's called the Duo-Jobmaster and it's part of the Ramset Fastening System.

For immediate service, call your local Ramset dealer. He's listed under "Tools" in the Yellow Pages. For information write to: ***Ramset Fastening System***

WINCHESTER-WESTERN DIVISION Olin 294-E Winchester Ave., New Haven 4, Conn.

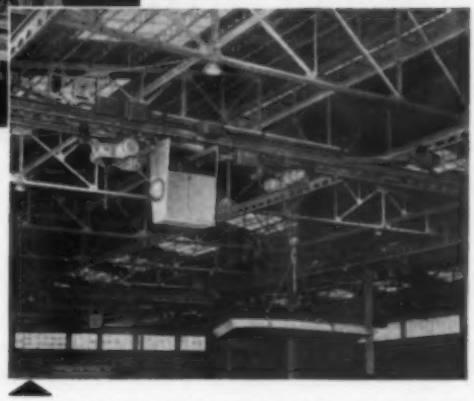
For more details circle 581 on Reply Card

Cranes Handle MILLIONS OF POUNDS Monthly



Bundles of reinforcing rod are easily lifted out of storage with the Tramrail cranes and delivered to the forming area shown here. The crane illustrated also handles rod out of incoming railroad cars and delivers it to storage quickly. The crane has two electric hoists each of 5000 lbs. capacity. Crane span is 70 feet.

Cleveland Tramrail Cranes *Keep Going at High Pace in* LARGE TEXAS STRUCTURAL STEEL PLANT



Handling a heavy pack of steel plates. Aisleways are not of concern when Tramrail cranes are used; in fact, most usual aisle space can be devoted to storage and other purposes. The crane cabs were fabricated by Central Texas.

THERE is little idle time during a working day for the Cleveland Tramrail cranes at Central Texas Iron Works Co., Waco, Texas. Both of the cab-operated cranes in the Shear and Reinforcing Rod Storage Building generally handle 3,000,000 lbs. each of steel rod, plate and miscellaneous items per month. This means many lifts and much travel in all directions. Eight hours is the standard working day.

Central Texas is one of the largest structural steel fabricating companies in Texas. They fabricate beams, trusses, tanks, stacks, etc., also form concrete rod for buildings and bridges.

Central Texas recognizes the advantage of materials handling equipment designed and built by specialists in this field. For many years they have used a large number of Cleveland Tramrail hand-propelled cranes with electric hoists in an old fabrication area. The cranes illustrated here were installed in 1954, when they enlarged the plant. The Cleveland Tramrail equipment has proven a big factor in facilitating handling and has been very satisfactory.

WRITE FOR FREE COPY of Engineering and Data Booklet No. 2008. Packed with valuable information. Profusely illustrated.

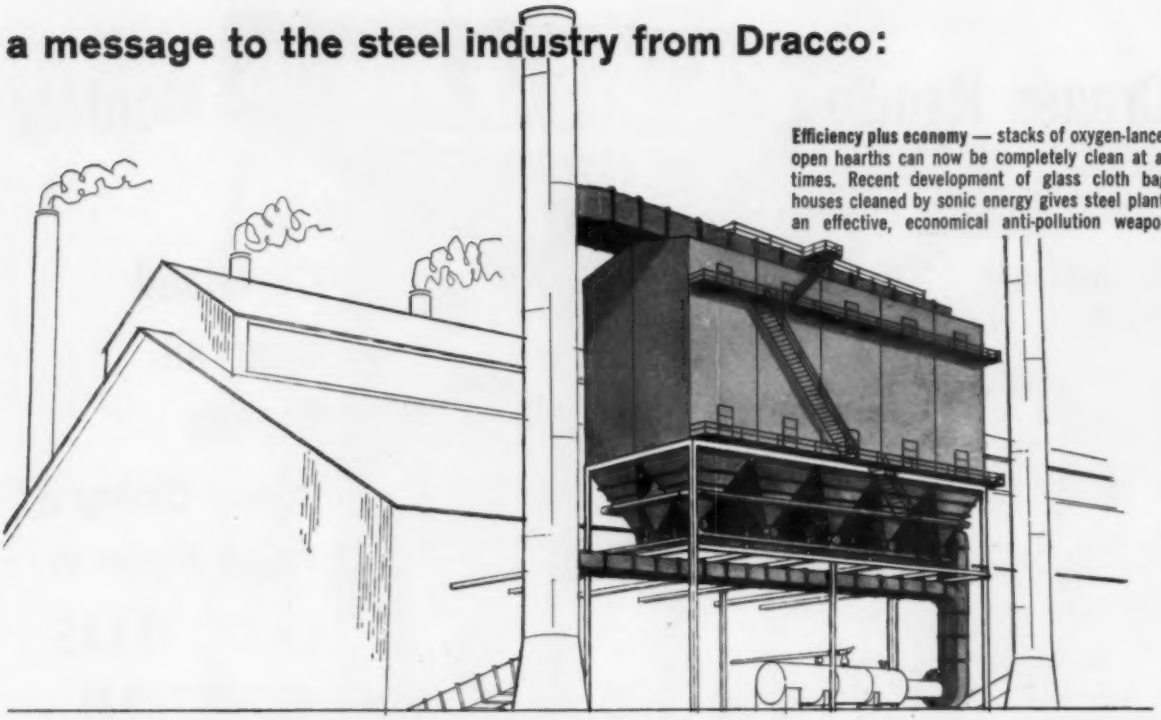
CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 7560 E. 290 ST. • WICKLIFFE, OHIO

For more facts circle 582 on Reply Card

a message to the steel industry from Dracco:



Efficiency plus economy — stacks of oxygen-lanced open hearths can now be completely clean at all times. Recent development of glass cloth baghouses cleaned by sonic energy gives steel plants an effective, economical anti-pollution weapon.

AIR POLLUTION CONTROL FOR OXYGEN-LANCED OPEN HEARTHS NOW COSTS LESS!

Dracco Glass-Bag Filters with patented sonic cleaning now offer the steel industry a practical solution to open hearth furnace gas cleaning. Under all operating conditions, they assure full-time, uniform high-efficiency collection at lower cost. Here are the facts:

• **Lower capital investment** can mean 33⅓ to 50% savings compared to less efficient, more costly devices currently used.

• **Lower maintenance costs**—including cost of infrequent bag replacements—can be realized. The reasons: (1) gas conditioning, with associated corrosion, is eliminated, (2) unskilled maintenance labor can be used, (3) no internal moving parts, (4) no acid mists deposited inside unit, (5) no elaborate seals or insulators, (6) no costly accessories—converters, transformers, controls, (7) long bag life —no severe flexing.

• **Extremely high efficiency** stays high at all times, regardless of fluctuations in dust and furnace conditions. Discharge free of visible solids can mean a clean stack for your plant.

• **Broad temperature operation** up to 600° F. is permissible with fiber glass bags. No cooling required when waste heat boiler is used.

• **Sonic cleaning — a must for open hearth dust and fume**—effectively removes accumulated particles from filter bags. Dracco offers patented apparatus insuring low back pressure and long bag life.

• **Built-in flexibility** counterbalances space requirements, permits use with any furnace, gas cooling method or materials handling system.

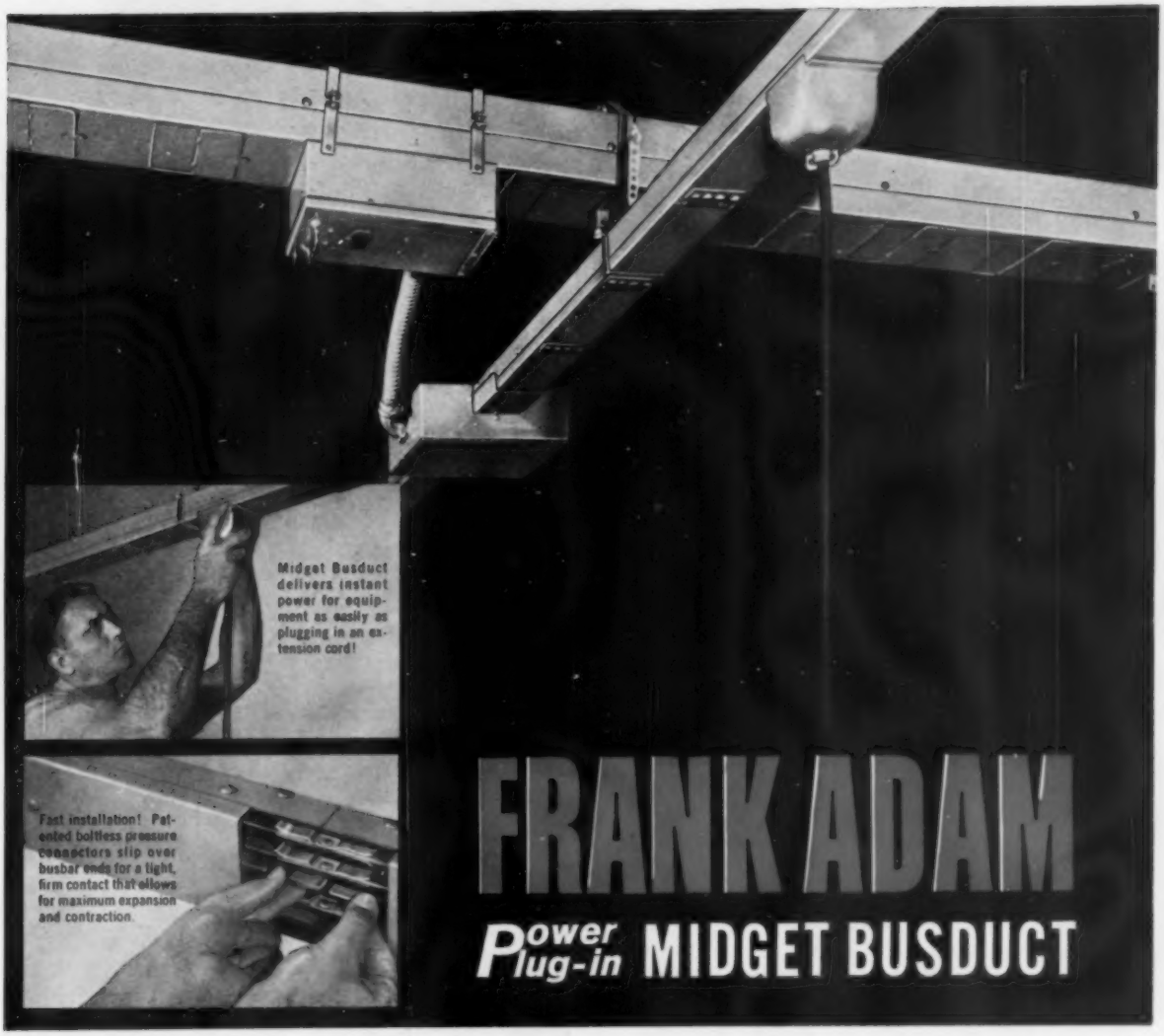
Rugged Dracco glass cloth baghouses can be custom engineered to give your plant clean stacks and better community relations. And you will be working with a firm having over 40 years experience in licking the toughest air pollution problems. For full details or expert consultation, contact: Dracco Division of Fuller Co., Harvard Avenue and East 116th St., Cleveland 5, Ohio.

DRACCO *airstream* conveyors
dust control equipment

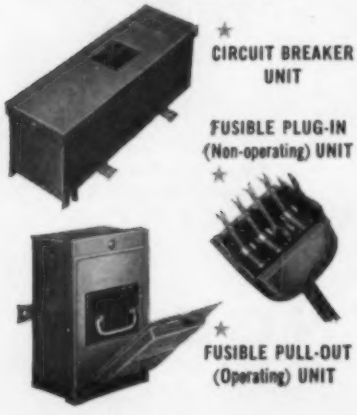
FULLER COMPANY GENERAL SERVICE

For more facts circle 583 on Reply Card

EXTEND ANY PRESENT BUSDUCT SYSTEM TO ANY SPOT IN THE PLANT FOR LESS THAN THE COST OF WIRE & CABLE!


Midget Busduct delivers instant power for equipment as easily as plugging in an extension cord!
Fast installation! Patented boltless pressure connectors slip over busbar ends for a tight, firm contact that allows for maximum expansion and contraction.
FRANK ADAM
Power Plug-in MIDGET BUSDUCT

CHOOSE FROM THREE TYPES OF PLUG-IN UNITS



★ CIRCUIT BREAKER UNIT

FUSIBLE PLUG-IN (Non-operating) UNIT ★

★ FUSIBLE PULL-OUT (Operating) UNIT

100-Amp. plug-in power fed from existing busduct to any location with MIDGET BUSDUCT

Although the initial price of Midget Busduct is slightly more than wire and cable, the saving on labor alone results in a surprisingly lower installed cost.

No cutting or bending, no threading of conduit is necessary with Midget Busduct. It is 100% salvageable when plant layouts are changed, or machine relocations are made. Quick availability of plug-in units permits load connections in minutes to save even more on labor.

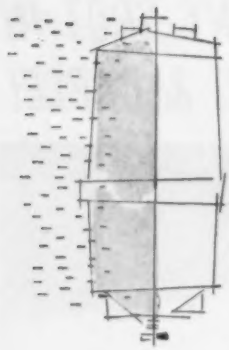
Either copper or aluminum conductors can be furnished. Midget Busduct has plug-in outlets every 10", on one or both sides, to accommodate three types of plug-in units, shown at left, in 30 to 100 amp. capacity. *Ask for complete information and prices.*

FRANK ADAM ELECTRIC COMPANY SINCE 1891
P O BOX 357, MAIN P.O. · ST. LOUIS 66, MO.

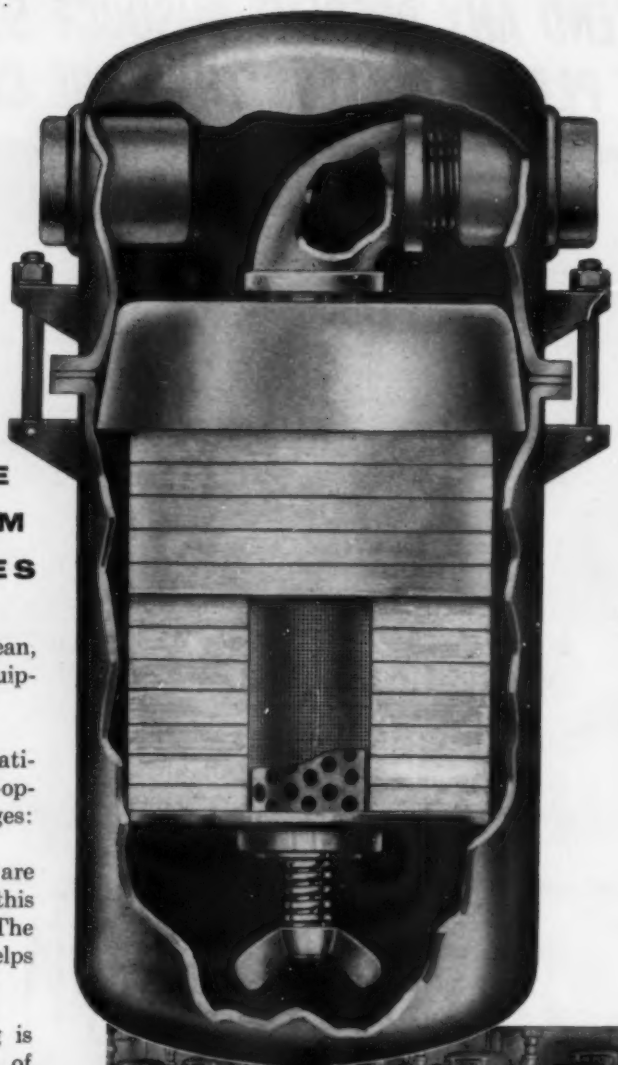
KEEP PACE ELECTRICALLY

busduct · panelboards · switchboards · service equipment · safety switches · load centers · Quikheter

For more facts circle 584 on Reply Card



DOLLINGER
DRY FILTER
SPECIALISTS
FOR
40 YEARS



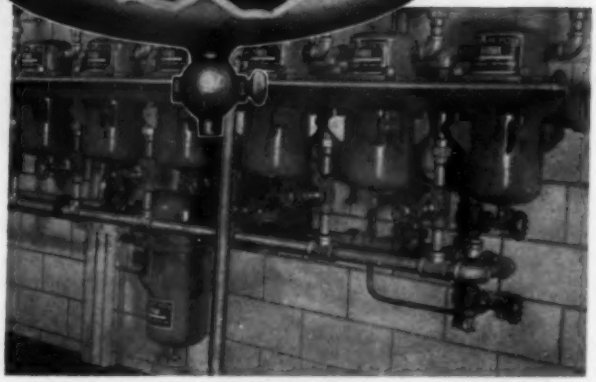
REMOVE MOISTURE AND DIRT FROM COMPRESSED AIR LINES

Dollinger Staynew Filters keep air dry and clean, assure smooth operation of mechanical equipment despite constant change in humidity.

Model AAPHS Staynew Filters protect pneumatically-operated controls, instruments and air-operated tools. They offer a variety of advantages:

- Low resistance—heavier dirt particles are eliminated before the air itself is filtered; this prevents clogging of the filtering element. The result is low resistance to flow; this helps maintain line pressures, saves horsepower.
- Continuous operation—frequent cleaning is eliminated because of a liberal amount of space in the housing for accumulated dirt and condensate; this can be drained without shutting down the line.
- Accessibility—interior parts are easily exposed for inspection and cleaning. Loosening of swing bolts permits removal of lower housing without breaking pipe connection.

For positive, trouble-free filtration, specify Dollinger. Call our representative nearest you, or write for Bulletin 200. Dollinger Corporation, Industrial Products Division, 55 Centre Park, Rochester 3, New York.



Part of an installation of 18 Staynew Filters protecting air-operated instruments in a power plant. Model AAPHS Filters operate effectively at pressures as high as 125 lbs. gauge.

PROTECTOMOTOR
STAYNEW
FILTERS

DOLLINGER

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

For more facts circle 585 on Reply Card

For more facts circle 586 on Reply Card →

AVAILABLE FOR IMMEDIATE DELIVERY
FROM YOUR LOCAL STEEL SERVICE CENTER

STEEL
SERVICE CENTER
INSTITUTE

INLAND

INLAND STEEL COMPANY

Notice how soft the shadows are on the walls? That's typical of light transmission through these domed Consolite fire-retardant skylights. Consolite (registered trademark) is a product of Consolidated General Products, Inc., Houston, Texas.

Safe, glare-free daylighting on a budget

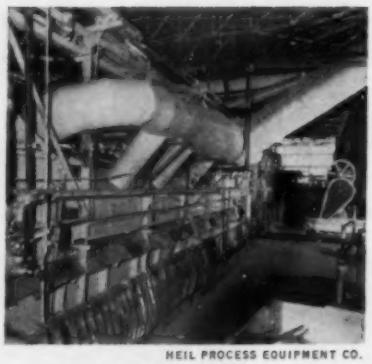
You can't see any "hot spots" under these skylights, can you?

They're made of a reinforced plastic that diffuses the light, banishes glare. Yet they transmit as much as 85% of the light that's available.

These domed plastic skylights are safer, because they can't shatter into a thousand flying fragments. Safer, too, because the plastic won't support combustion—can't feed a fire, ever. They cost less to buy and to install than conventional skylights: they're made in one piece, with integral flashing.

If you're working on plans that call for fire-retardant construction, you'll want to know more about this safer plastic and the many interesting things you can do with it. It's called Hetron.® You can get it made up into glass-reinforced corrugated sheets, flat panes, and striking textured interior panels, as well as skylights. Corrosion-resistant pipes, ducts, and process equipment, too. All are designed to meet stiffest fire codes.

We don't make these structural materials; we just supply the basic plastic, Hetron, that makes them safer. We'll be glad to send you a list of expert fabricators who can supply you. Just write us or check the reader's service card.



HEIL PROCESS EQUIPMENT CO.

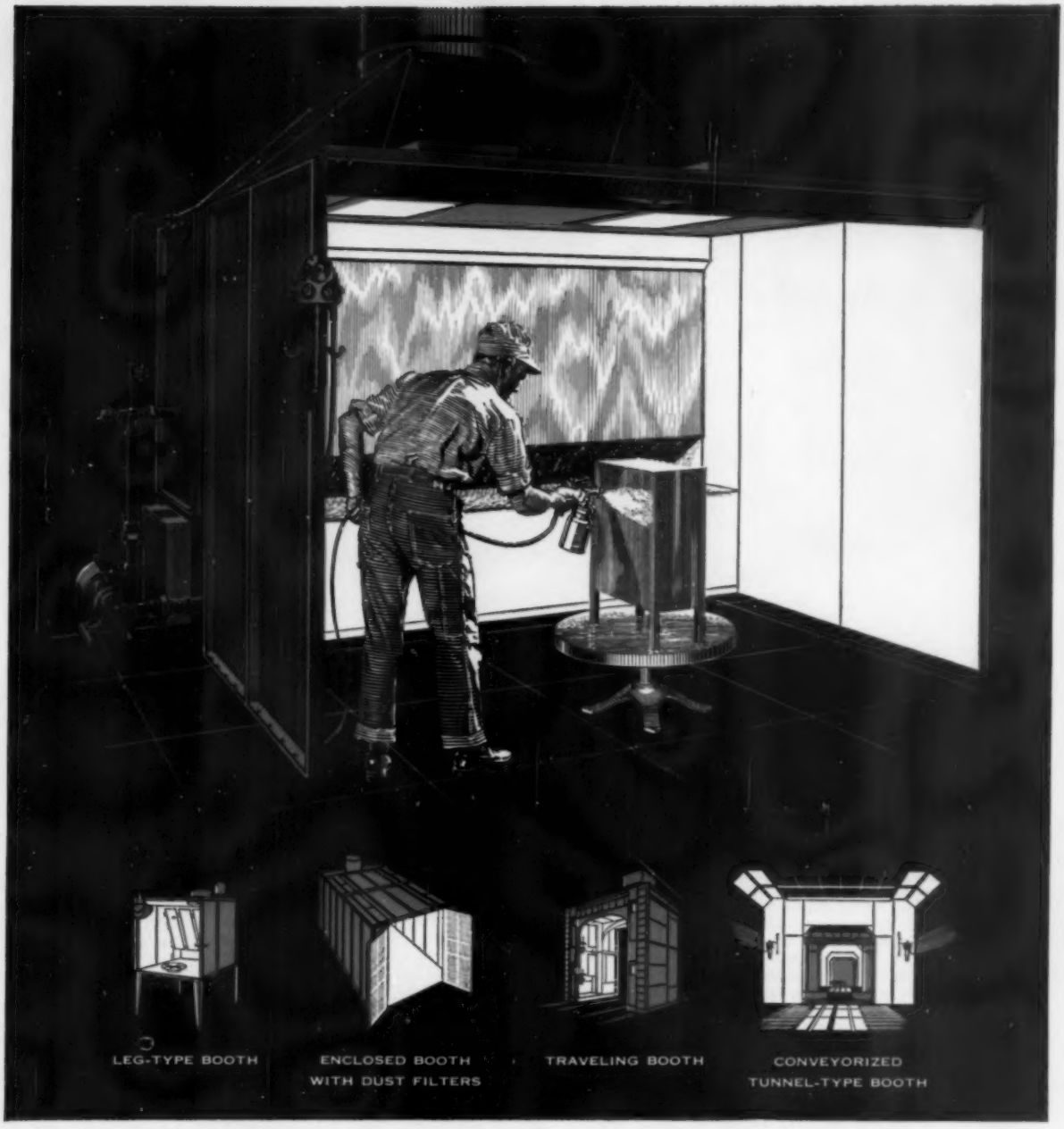
Handle corrosive fumes safely in fire-retardant ducts fabricated with Hetron polyester. In plant after plant they outlast other materials, cut replacement and upkeep costs. Hetron ducts above saved **two-thirds** the cost of replacing a previous system damaged by fire; cost less to install; made sprinklers unnecessary.

DUREZ PLASTICS DIVISION

HOOKER CHEMICAL CORPORATION, 3905 WALCK RD., NORTH TONAWANDA, N. Y.

HOOKER CHEMICALS PLASTICS

For more facts circle 587 on Reply Card



spray booths from DeVilbiss have high paint-trapping efficiency . . . easy to install, operate, clean. They're part of DeVilbiss' complete line of matched equipment for coating and finishing that includes: airless, conventional, hot-spray outfits; automatic spray, dip and flow coaters; air compressors, air and fluid hose, ovens, spray washers, air-replacement units, complete "turn-key" finishing systems.

Talk to DeVilbiss about all your spray-coating requirements

FOR TOTAL SERVICE, CALL
DEVILBISS

THE DeVILBISS COMPANY, Toledo 1, Ohio. Also Barrie, Ontario; London, England; São Paulo, Brazil. Branch offices in principal cities.

For more facts circle 588 on Reply Card

EXIDE POWER PACKAGE

Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa. (ESB)

WHICH BATTERY FOR RAMPS AND CONCENTRATED HIGH POWER DEMANDS?

In any electric industrial truck application, the best battery choice is the one which meets the requirements of the particular conditions of use. Different applications may call for different types of batteries. And Exide offers the broadest line so that you may meet your own requirements most exactly. It includes the high capacity Exide-Ironclad with either square or round tube positive plate construction; the long-life Exide nickel-iron-alkaline (invented by Thomas A. Edison); and the Exide-Powerclad premium flat plate.

Ramps and other concentrated high power applications for electric industrial trucks make the sternest demands on batteries. They eat up battery power at the highest rate. So your trucks need extra capacity batteries—often the highest that they can carry. More battery power means your trucks can lift more, do more work, and work longer shifts without recharging. In other words, it is the key to maximum plant productivity.

The Exide Power Package: Broadest choice of all types of batteries and chargers to meet all requirements, plus factory-quality service for both batteries and chargers.

Which battery gives you the maximum capacity? There is no secret to it. Today's advanced-design TGS Exide-Ironclad electric truck battery has more capacity per unit of volume than any other—11% more than the second most powerful battery. It is available now in ratings for all trucks—both rider and walking types—which use 22⅝-in.-high batteries.

Tubular construction

Exide-Ironclad is the lead-acid battery with tubular construction of the positive plate. Ever since Exide introduced this design, over 50 years ago, it has constantly led the motive power lead-acid battery field in capacity, life and economy.

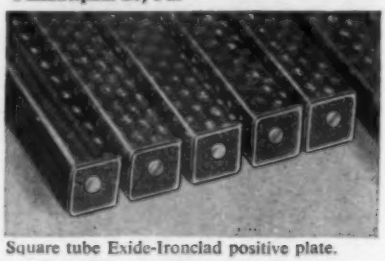
The reason is really easy to see. Tubular construction makes it possible to pack more active material into every plate. And the braided glass fiber tubes retain the active material so effectively that battery life is significantly greater—resulting in lower annual cost. The tubular design also protects the vital grid members from electrolyte action, which results in grid corrosion. The TGS Exide-Ironclad introduced the latest advance in battery design: square-shaped tubes. These plates pack roughly 33% more active material per plate than round tubes, and battery capacity was increased to the highest level ever achieved.

For more facts circle 589 on Reply Card

Power package

A complete analysis of total battery power operating costs for electric trucks proves that maximum economy may be achieved only by considering the entire power package: battery, charger and required service. This is all included in the Exide Power Package. Your Exide representative recommends the particular combination of equipment and service called for by your conditions. So you are assured of having adequate capacities to do the job, yet you are not paying more than you should because of capacity you don't need.

Ask about the Exide Power Package for your trucks. Call your nearby Exide man. Or write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.



Square tube Exide-Ironclad positive plate.

Exide®

Stronger construction—Neater appearance—Easier to assemble

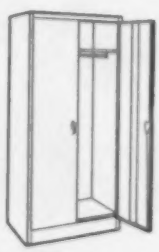
HALLOWELL

800 SERIES STORAGE CABINETS*

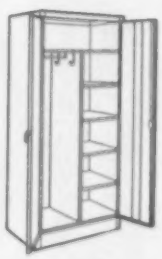
Here is a new and better line—at *no increase in cost!* Made of heavier gauge steel for maximum durability. Better looking, too. All parts fit flush. No exposed bolt heads on front or sides. Doors and frame are pre-assembled . . . insure accurate fit and easy mounting. 3-point locking with spring tension clips for positive, quiet operation. Chrome plated handles with lock. Built-in shelf supports permit easier shelf adjustment on 2-inch centers.

**Meet Federal Specification AA-C-31a*

MODEL 815
Storage cabinet with double door and 4 adjustable shelves.



MODEL 835
Wardrobe cabinet with double door . . . holds 12 to 16 heavy coats.



MODEL 855
Combination cabinet with double door . . . wardrobe and 4 shelves.

SIZES: 36" wide, 78" high, 18" and 24" deep.

Mail coupon for more information

COLUMBIA-HALLOWELL Division SPS
Jenkintown 26, Pa.

Please send me complete information on the new Hallowell Storage Cabinets.

NAME_____ TITLE_____
(Please Print)

FIRM_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

COLUMBIA-HALLOWELL Division **SPS** JENKINTOWN 26, PA. • SANTA ANA, CALIFORNIA

where reliability replaces probability

For more facts circle 590 on Reply Card

PROTECTOR OF YOUR PROFITS!

Dust is a destroyer. It corrodes. It abrades. It ups down-time. That's why you need protection from this menace. Pangborn Dust Control Equipment provides you with this protection.

Eliminating costly dust damage is just one of the many money-saving functions of Pangborn Dust Control Equipment. It also improves plant housekeeping. It protects men as well as equipment. It salvages usable dust. And it can improve your relations with your community.

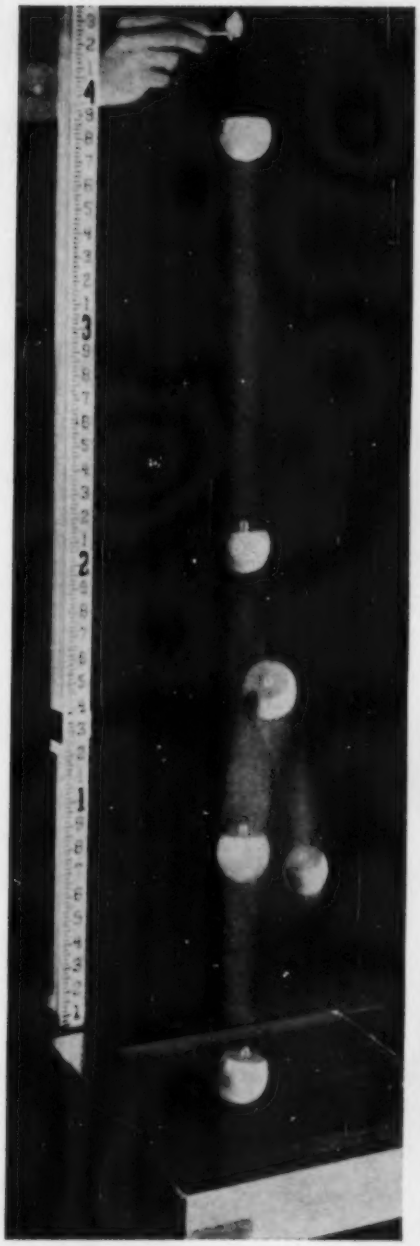
Pangborn has the right dust collector to fit every requirement. Cloth Bag, Tube, Screen, Self-Cleaning and Unit Type Dry Collectors, also Wet Collectors in all sizes. For more facts, write:

Pangborn Corporation, 3200 Pangborn Blvd., Hagerstown, Md.; Pangborn Canada,Ltd., 47 Shaft Rd., Toronto (Rexdale), Canada —Manufacturers of Dust Control, Blast Cleaning, Vibratory Finishing Equipment; Rotoblast® Steel Shot and Grit®.

Pangborn
OF HAGERSTOWN

For more facts circle 591 on Reply Card

The answer to a maintenance man's prayer ...Johns-Manville CORRULUX®



EASY TO WORK...EASY TO HANDLE. Cut special shapes and sizes with a power saw, hacksaw or handsaw. No tricks to learn; Corrulux drills and fastens readily. Light and easy to handle, Corrulux Flat Panes come in sizes that fit most windows. Replace glass with shatter-proof Corrulux!

SHATTER-PROOF! When a 2½ inch steel ball weighing 2.06 lbs. was dropped from 4 feet, the ball bounced approximately 1½ feet—but did no damage to a Structural Grade Corrulux Flat Pane!

EASY TO INSTALL. End worries about window breakage forever! As easy to install as glass, yet protects against storm damage, vibration, vandalism and other hazards. Corrulux eliminates glare, spotlighting and harsh shadows . . . diffuses light at all angles. Corrulux admits over 80% of the light that strikes its surface, depending on color.

WHERE TO GET CORRULUX. Look for the finest translucent panel on the market—at an economical price—in the Yellow Pages under *Plastics*. Or write to Johns-Manville, Box 158, Dept. PE 561, New York 16, N. Y. In Canada, Plastics and Allied Building Products, Ltd., Dundas, Ont.

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

For more facts circle 592 on Reply Card

PLANT ENGINEERING EQUIPMENT.

Edited by M. E. Heniken

VIBRATOR moves hard-to-flow parts, materials

Vibra Pak goes to work right where it's plugged into a 110-v a-c power supply. The portable unit keeps small parts, granular or bulk materials moving freely in hoppers, tracks, bins and chutes. Attached at the point where vibration is desired, the small box-like housing initiates a gentle, pulsating

motion at the rate of 3600 vbm. Vibra Pak comes in two series (EV and PEV), three models in each. Series EV has a dual range, Model EV-1, only 5⅜ in. long, 2¼ in. wide and 1½ in. high, with input of 9 w, operates with the standard 3600 vbm. Other more powerful models are described as quiet as an ordinary motor. Automatic Feeder Co.

For details, circle 1 on Post Card

Use the Reader Service Cards provided on pages 217-218 to ask for more information on any of this equipment.

CEILING FIXTURE provides both light and air

The Triple-Shell Lumi-Flo, providing light and cool or warm air from a single concealed ceiling fixture, is a joint development of the Benjamin Div., Thomas Industries Inc., and Tuttle & Bailey, Div., Allied Thermal Corp. The unit is adaptable for use in almost any building with any type of drop ceiling. A feature is isolation of the air passageway from the troffer housing by fiber glass insulation and an insulating air gap—removing possibility of temperature variations affecting the light output. A single 1-by-4 or 2-by-4 ft unit handles up to 200 cfm. The troffers feature a new shallow depth of only 4⅞ in. at the ends, for easy clearance of beams and pipes in the plenum. Installation time is reduced by use of a snap-in damper assembly and a side-mount hanger. Benjamin Div., Thomas Industries Inc.

For details, circle 2 on Post Card

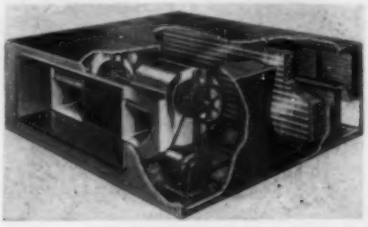
URETHANE FOAM offers high insulating efficiency

Rigid urethane foam sheets are introduced for use in perimeters, freezers, cold-storage plants, electrically-heated and air-conditioned buildings, ducts, walls, pipes and other areas where light weight and space saving are desired. This insulation is available in panels of various thicknesses to 11 in., as well as in blocks for pipe insulation and lagging. Barrett Div., Allied Chemical Corp.

For details, circle 4 on Post Card

17-TON EVAPORATOR offers all-around flexibility

The 17-ton blower-powered evaporator shown features unusual flexibility. With evaporator coil and filter section fixed in a horizontal arrangement, variations in blower location and air-flow direction provide for upflow, downflow or horizontal air delivery. Blower section can mount horizontally at the end of the evaporator-filter section, or on



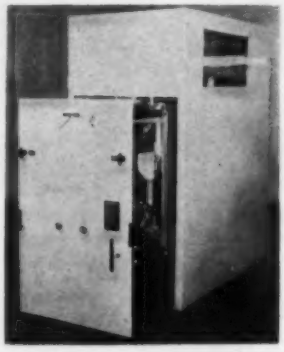
top for vertical upflow or left or right hand horizontal air delivery. The evaporator coil is constructed of ripple-edge aluminum fins flat-bonded to seamless copper tubes. It is removable from cabinet and may be turned end for end, permitting refrigeration line connection at either end of cabinet. Blower sections consists of twin 15-in. blowers on a single shaft and powered by whatever motor and drives are required. Filter section connects to either blower or coil section air intake and access doors are at both ends. Lennox Industries Inc.

For details, circle 5 on Post Card

SWITCHGEAR protects high voltage distribution circuits

Moderate cost protection of 2400- to 13,800-v distribution circuits is offered by this enclosed switchgear, Type DFS. It is intended for light industrial and other applications requiring compact, reliable protective equipment but not requiring use of circuit breakers. It is built around a drawout design in which switch-and-fuse element is withdrawn from enclosure whenever fuses are replaced. Equipment can be had for indoor or outdoor service, as single-circuit units or multi-circuit switching centers for service entrances and transformer primary or secondary switching. It comes in 5 and 15 kv, in 600- and 1200-amp continuous.

Switches are designed to interrupt load currents equal to continuous load ratings for at least 20 times. Equipped with boric acid fuses or current limiting fuses, the equipment interrupts fault currents to 250 mva at 4160 v and 500 mva at 13,800 v. Use of boric acid fuses permits application to transformers up to 5000 kva at 13,800 v. For closing against faults and to make manual operation independent of operator, energy required to open and close the switch is charged into a spring system manually or by optional motor-driven charging mechanism.



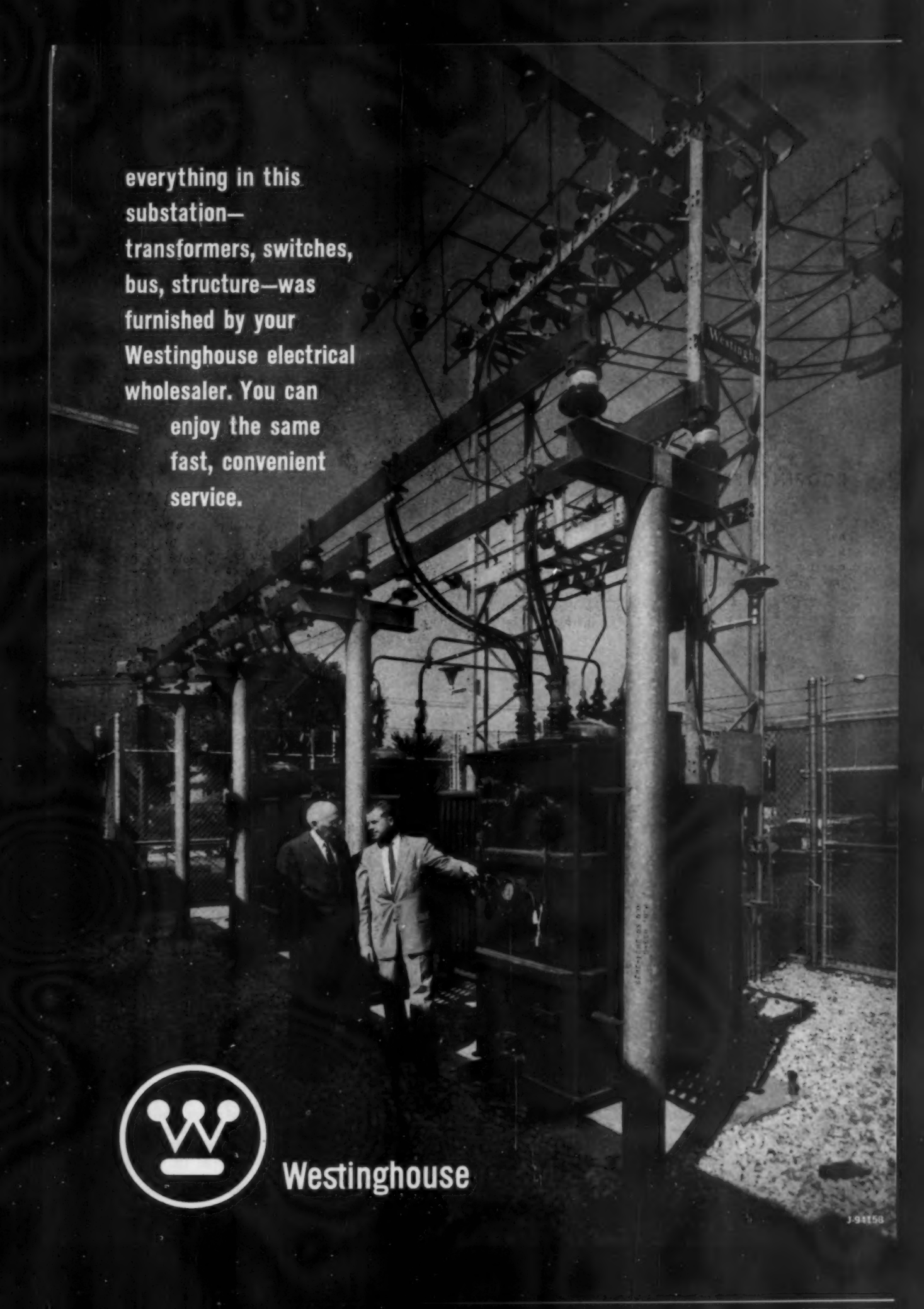
The stored energy mechanism provides force to close switch against momentary currents of 60,000 amp the 5-kv switch, 40,000 amp for the 15-kv switch. Westinghouse Electric Corp.

For details, circle 3 on Post Card

BUCKET ELEVATOR comes in easily-assembled kit form

Buck-El-Lift-It-Kit contains the parts for a rugged, yet light weight carbon and steel bucket elevator which can be assembled on the job by one or two men. Units are inexpensive and

For more facts circle 593 on Reply Card


everything in this substation— transformers, switches, bus, structure—was furnished by your Westinghouse electrical wholesaler. You can enjoy the same fast, convenient service.
Westinghouse

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

will elevate a wide range of bulk materials at capacities to 4 cfm. Basic kit includes a bottom section with slide gate, two mid-sections, head section with discharge chute, belt or chain and buckets, drive components with motor optional, and necessary hardware. The Bucket Elevator Co.

▲ For details, circle 6 on Post Card

ROOFING FABRIC forms monolithic roof surfacing

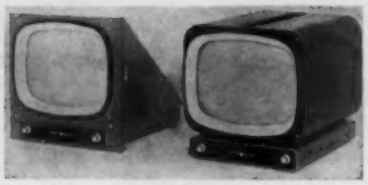
When used with company's silicone liquid roof coating, Monoglas is said to form a monolithic surface that becomes an integral part of the original roof. Tiny pores in the material allow any trapped air to escape and create

an integral bond to the existing surface. Monoglas weighs only 8 lb per 100 sq ft; it is supplied in rolls of 540 sq ft. It won't separate from its imbedding material, says manufacturer, and the surface formed is seamless. The Monroe Co., Inc.

▲ For details, circle 7 on Post Card

CLOSED CIRCUIT MONITOR for industrial television

An expanded brightness range fits these monitors for use in areas of high ambient light, and because of this, manufacturer has made available an accessory polarized safety glass faceplate for further minimizing reflections and improving contrast ratio. The monitors are suited to surveillance of hazardous areas, gate monitoring, meter reading, security surveillance, pipeline inspection, technical instruction, etc. Although capable of three times



the picture quality, they are simpler to maintain and adjust, according to manufacturer.

The monitors come in cabinets or rack mounting and in three screen sizes: 14, 17 and 21 in. Size, focus and linearity controls are operated individually—adjustment of one doesn't affect the others. Input circuit is said to substantially cancel out picture disturbance caused by surrounding high-current wires. The monitors operate with any standard monochrome camera. General Electric Co.

▲ For details, circle 8 on Post Card

COATING protects chimneys against acid corrosion

Stackfas is a spray-applied, non-asphaltic coating for the interior of brick, steel and concrete chimneys. Formulated to resist acid corrosion from high sulfur fuels, this product is claimed effective against acids formed by sulfur dioxide, sulfur trioxide, hydrogen chloride and hydrogen fluoride. According to manufacturer, Stackfas was developed to meet industrial requirements for a coating to resist destructive corrosion resulting from greater use of more economical low cost coal, heavy fuel oil, refinery sludge and sour gases in boiler operation. Tests of Stackfas in public utilities and chemical plants are reported to show outstanding resistance to acids, heat and fly ash abrasion. Benjamin Foster Co.

▲ For details, circle 9 on Post Card

DRY CHEMICAL UNITS extinguish all kinds of fires

These all-purpose dry chemical fire extinguishers are announced as approved by both Underwriters' Laboratories and Factory Mutual for use on all three classes of fire. ABC Extinguishers expel Formula S, a powder having a monoammoniumphosphate base treated with a silicon resin, which reacts chemically against fires. Against Class A fires (paper, wood, fabric, rubbish) the dry chemical seals off the fire with an insulating cover, preventing re-ignition or flashback. It smothers and cools Class B (flammable liquids, such as gasoline, oil, paint, alcohol) and Class C (electrical) fires. When used on the latter it does not conduct electricity, manufacturer points out. ABC Extinguishers come in 20- and 30-lb sizes. Pressurized in heavy-duty steel cylinders with 150 lb of nitrogen or dry air, Formula S can be expelled at a safe fire fighting distance of 12 to 15 ft. Fyr Fyter Corp.

▲ For details, circle 10 on Post Card

MOBILE RAMP speeds receiving, shipping jobs

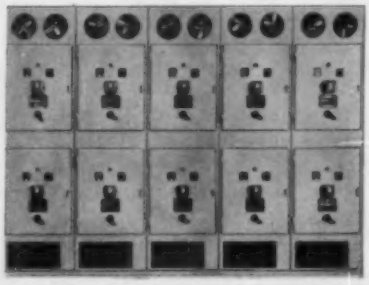
Of welded steel construction, the Mobil-Board is claimed to offer low cost, long service and full utilization of a plant's fork lifts in loading and unloading operations. Unaided, a fork

lift operator can use his truck to push or pull the ramp into place; when it's locked into position, he drives the fork lift over the ramp to haul materials in and out of freight cars and highway trucks. With the Mobil-Board, highway trucks and trailers can be spotted where handy, as at point of storage. Height range of a standard unit is 27 to 54 in. Conrad Equipment Co.

▲ For details, circle 11 on Post Card

MULTI-CIRCUIT CHARGER services truck batteries

Silicon rectifier-type charger units capable of charging several electric material handling truck batteries simultaneously are announced as saving floor space up to 50 per cent and requiring less maintenance than conventional horizontal motor-generator equipment. Each Exide Multi-Circuit ETR con-



tains two automatic, tapering-current charging units and control panels within a single cabinet. Each can connect with other such units.

Because the chargers are cooled by forced filtered air—with intakes and outlets at the front—and because all components are accessible via remov-

HERE!

ADD UP TO 4% TO YOUR NET PROFIT

Caught in a profit squeeze? The contents of the Texaco man's briefcase can help you do something about it. Inside is Texaco's "Stop Loss" Program. It's a new cost control tool that can knock as much as 15% off your maintenance costs by showing you how to organize your lubrication. You can tack this saving directly onto profit—for an average 4% net gain. It will pay you to get the details. Write for our folder "How to Starve a Scrap Pile." **TEXACO** INC., 135 East 42nd Street, New York 17, N. Y. Dept. E182

TEXACO

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

able front and side panels, the cabinets can be flush mounted against a wall. The largest standard twin-circuit ETR model, a three-phase unit for charging 18-cell batteries rated at 1000 amp-hr capacity, protrudes only 33¼ in. from wall, is around 25⁵⁄₁₆ in. wide. These units provide inherently tapering-current charging. Charging currents are automatically reduced in proportion to rising voltages of batteries on charge. The charger turns off automatically. Exide Industrial Marketing Div., The Electric Storage Battery Co.

▲ For details, circle 12 on Post Card

PALLET LOADER for high-speed production lines

Designed strictly for high-speed production in quantity, the C/CB Palletizer will receive packaged products and automatically arrange them in pre-de-

termined pattern with specified number of tiers. It loads packages in interlocking patterns (or columnar) onto wood, paper or disposable pallets. Palletizer is electromechanical in operation, has few moving parts and simplified controls. Challenge-Cook Bros. Inc.

▲ For details, circle 13 on Post Card

WET-SURFACE ROOF REPAIR in liquid or plastic form

Repairs made with Wet Seal are immediate and the material can be applied while it is raining or after, while the surface is still wet or even covered with water. This product, in both liquid and plastic form, is ready to use. Compatible with water during application, it is waterproof after being applied. It is suitable for all types of roof surfaces to repair and seal large areas where there are numerous leaks or where the leak cannot be pinpointed (liquid) and to repair seams, flashings, cracks, holes, skylights, ducts, copings etc. (plastic). Revere Chemical Corp.

▲ For details, circle 14 on Post Card

SPEED REDUCER comes in new larger size

Newest of this manufacturer's Torque-Arm Speed Reducers is Size 17, a single reduction unit with 5:1 gear ratio capable of transmitting 50 per cent more horsepower at output speeds to 400 rpm. This shaft-mounted reducer develops greater torque than

any other single reduction unit in the line, and can accommodate 60-hp motors in the top range of output speeds based on Class 1 AGMA ratings. It may be applied to equipment operating in the speed range above that of company's 15:1 and 25:1 double reduction models and in the horsepower range exceeding that of the No. 16 reducer, designed for motors up to 40 hp. The No. 17 is available from stock for horizontal shafts, may be ordered for vertical or inclined shafts. Bulletin 600 gives data. Dodge Mfg. Corp.

▲ For details, circle 15 on Post Card

PIPE INSULATION made of flexible foamed plastic

G-B Ultra*Foam, in tube or sheet form, is used to insulate liquid cooling and heating lines from sub-zero to 220 F. Its closed cellular structure gives it a K factor of 0.28 at 75 F mean temperature, and a water vapor transmission rating of less than 0.1 perm. The product's fire rating is given as "self-extinguishing." Tubular G-B Ultra*Foam can be slipped over new piping before installation, or slit longitudinally and snapped over existing piping. Sheets of it may be fabricated into pipe covering for sizes over 3 in. IPS. Installation time savings up to 50 per cent are announced as compared with wrap-on, rigid block, and multiple-piece coverings. The tube form comes in 6-ft lengths, ¾- to 3½-in. diam, in three wall thicknesses, each calculated to prevent condensation on cold lines within recommended ranges. The sheet form measures 30 by 36 in., comes in ⅛- to ¾-in. thicknesses. Gustin-Bacon Mfg. Co.

▲ For details, circle 16 on Post Card

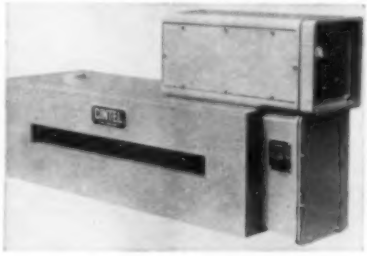
LINT ARRESTOR removes fibrous materials from air

Lint-A-Maze is a self-cleaning, automatic filtering and collection device for removing heavy concentrations of lint and fibrous material from air in high volume applications. Sizes available meet air flow requirements from 7,000 to 150,000 cfm. Extremely low pressure drop and high arresting efficiency with velocities of 250 to 1900 fpm are features of the machine. Lint, chaff, leather cuttings, feathers and similar wet or dry materials can be removed from the air with the mechanism, which can also be used in conjunction with fine particle filtering equipment. Air-Maze Div., Rockwell-Standard Corp.

▲ For details, circle 17 on Post Card

METAL DETECTOR protects machines and products

The Industrial Metal Detector protects against product contamination and machinery damage caused by metal chips and particles. It is sensitive to both magnetic and non-mag-

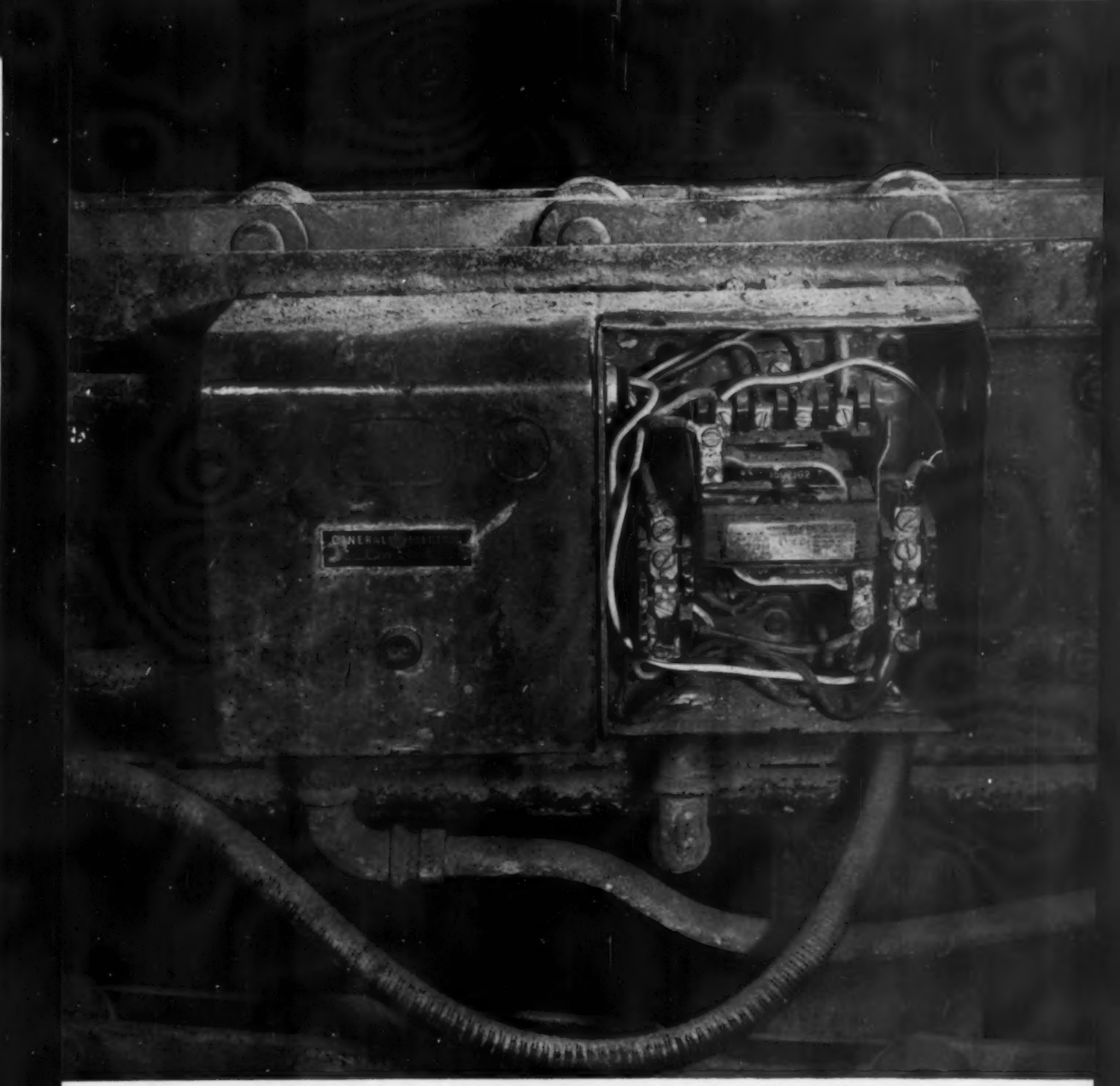


netic metals, and an adjustment is provided for decreasing sensitivity if application warrants. Moderately priced, the equipment consists of a power unit, search head and amplifier. The search head—available in several sizes—is in the form of a window through which the product to be inspected passes, either on a conveyor belt or by gravity feed. Instrument Corp. of America.

▲ For details, circle 18 on Post Card

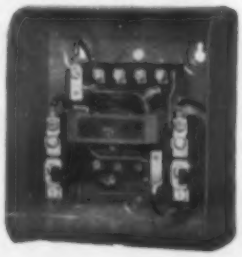
CONTROL VALVES in cast steel and stainless steel

Control valves are now available in cast steel as No. 670 and in stainless steel as No. 770, in ¼ to 1¼ in. capacities. Stainless steel trim is standard



Even When Caked with Concrete Dust...This Starter Gives More Life Than You'll Ever Need

This photo of General Electric magnetic starters operating a conveyor in a concrete block making plant helps prove one important point: General Electric starters will give *more life than you'll ever need* for almost any application! Some of the reasons? Contacts are slanted so dust slides off. Horizontal wedge action reduces impact, vibration, wear, and contact bounce. Unique magnet design gives positive pick-up and clean dropout every time. Molded coil resists dust, oil, water, mechanical abuse. But the best proof is *your own test* of the MEASURABLE ADVANTAGES of General Electric starters. Call your G-E sales engineer or distributor today. Or write for GEA-7020. General Electric Co., Section 813-32, Schenectady, N. Y.



Progress Is Our Most Important Product

GENERAL ELECTRIC

For more facts circle 595 on Reply Card

PLANT ENGINEERING EQUIPMENT

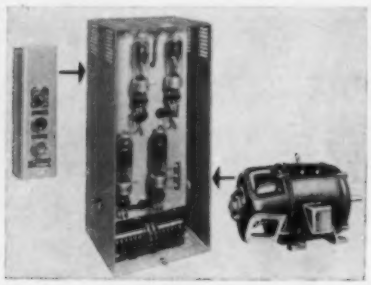
(Begins on page 168)

with linear flow characteristic sliding gate seats. Valves are suitable for wide range of tough chemical applications as well as steam, air, water, oil and gas. They are self-operated or controller-operated, for 300 psi and 500 F wsp service. Bulletin JNP-7 gives more information. OPW-Jordan Corp.

▲ For details, circle 19 on Post Card

ELECTRONIC DRIVE offers economy, wide speed range

Reduced maintenance, close speed regulation and a speed range from 2:1 to 100:1 are announced for the Class 8833 Type BG Drive. Maximum and minimum speed limits are adjustable within controller. The drive operates from a



single-phase a-c supply. A pair of grid-controlled thyratrons and diode tubes provide full-wave rectified voltage to drive motor armature. For precise speed regulation, regardless of load, an IR drop compensating network is employed. The drive also provides short circuit protection, under voltage and overload protection, a timed method of accelerating to pre-set speed, tube circuits that are fail-safe on filament burn-out. Controller and push button station are enclosed in heavy-duty sheet steel. For ease of maintenance, the panel swings down and rests on "stop pins" to provide component accessibility from rear of panel. Square D Co.

▲ For details, circle 20 on Post Card

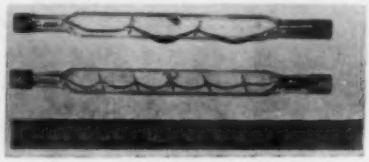
COMBINATION WRENCH is extra long for added leverage

Twenty-four Armaloy Extra Long Combination Wrenches featuring open end-box pattern have been introduced with nominal openings ranging from 3/8 to 2 in. and lengths from 7 to 30 in. The wrenches are particularly useful where additional leverage is required to loosen tight nuts. Armstrong Bros. Tool Co.

▲ For details, circle 21 on Post Card

ROUGH SERVICE LAMPS stand shock, vibration

Quartzline incandescent lamps designed to withstand shock and vibration encountered in adverse operating conditions are being produced in 500-w, 120-v and 1500-w, 240-v sizes, priced around $16 and $24. A principal application is expected to be on bridge



cranes. Quartzline lamps come in the form of quartz tubes and are said to offer more light, twice the rated life and better light control than available with incandescent bulbs of the same wattage. The new "rough service" models have less space between filament supports and more supports. The 500-w lamp has five supports, instead of the two on conventional models, as shown, and the 1500-w size has 15, instead of eight. No appreciable change in light output results, says manufacturer. General Electric Co.

▲ For details, circle 22 on Post Card

CONDENSER has its coils arranged in V formation

The V-Con is a remote air-cooled condenser with coils arranged in a V-shape so that air is drawn through them and discharged upwards by the propeller fans, an arrangement providing a low silhouette in a minimum of floor space. Other features include direct drive fans, totally enclosed motors, and aluminum cabinets. The V-Con is be-

ing offered initially in 3- to 10 ton capacities. Specifications are in Bulletin VC 103. Halsted & Mitchell Co.

▲ For details, circle 23 on Post Card

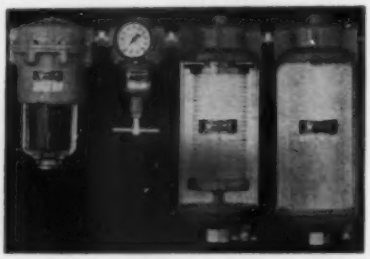
CENTRIFUGAL PUMP employs double ball bearings

This two-ball bearing end suction centrifugal pump is suited for belt or direct motor drive. Capacity range is from 10 to 300 gpm, with heads to 150 ft. "Back-pull-out" feature enables pulling working parts without disconnecting casing from piping. Stuffing box and split gland are standard, but mechanical seal is available at no extra cost. Seal is designed for temperature to 180 F when handling non-abrasive fluids. Pump is suitable for booster operation when suction pressure does not exceed 25 lb. The Deming Co.

▲ For details, circle 24 on Post Card

AIR DEHYDRATOR is flexible, economical

Lower in cost than most units for lowering the dew point of compressed air, the Chem-Guard Dehydrator is intended for use where instrument-pure air is not required throughout the plant. Because the Chem-Guard is made up of standard units packaged to fit individual needs, it is more economical to buy and maintain—the



package shown costs about $115.00. Its first unit is for removing entrained moisture and small dirt particles and has a built-in automatic drain. The second unit, a precision air pressure regulator, is followed by an air filter which removes oil fumes, prohibiting them from coating the silica-gel desiccant in the last unit. It is a dryer capable of lowering the dew point to —65 F. The package can be had with any of the units omitted, or tailored to an application, so you don't pay for components not required.

The dehydrator doesn't need reactivating, although it can be. A separate replacement desiccant charge is less costly and comes vacuum sealed for indefinite storage. The desiccant is visible; it turns from blue to white when it's saturated and needs changing. Rated up to 10 cfm at 100 psi, the

Air operates this folding machine to provide the neatly folded, factory-fresh shirts found in popular shirt stores. In the background, left, is an air- and steam-operated pressing machine that furnishes smoothly pressed shirts in seconds.

Compact 25S2 distributes air through 2-inch air-mains and laterals to individual machines. Mr. Hopper, (at right), expects "many years of trouble-free service from the Model 25S2 compressor."

Van Heusen "cuts operator fatigue– ups output per machine by 10% to 20%" with a

LE ROI 25-HP STATIONARY COMPRESSOR

Shirt-making is exacting work. It's so tiring that an operator's output can drop 40% in five hours. To reduce fatigue and to maintain efficiency, "we prefer air control for the more delicate operations of sewing and trimming machines, laundry, pressing and creasing work," reports Charles G. Hopper, assistant to the production manager of the Pottsville (Pa.) plant of Phillips-Van Heusen Corp.

At least some of the credit for reducing fatigue and increasing production is given to the 25 horsepower Le Roi compressor which provides air-power in their shirt factory.

The 105 cfm, 125 psi capacity of the Le Roi 25S2 air-cooled compressor more than meets current needs, and provides for the addition of more air-operated machines. Mr. Hopper states that the unit operates 10 hours a day, five and one-half days a week. To assure dependable air supply, valves of the 25S2 are inspected weekly, and oil is changed every 200 hours.

Why don't you check the benefits of pneumatic operation? Le Roi can meet your needs with Westinghouse unit-type and Le Roi stationary air compressors from ½ to 100 hp. See your Le Roi distributor for more information. Or write to Le Roi Division, Westinghouse Air Brake Co., Sidney, Ohio.

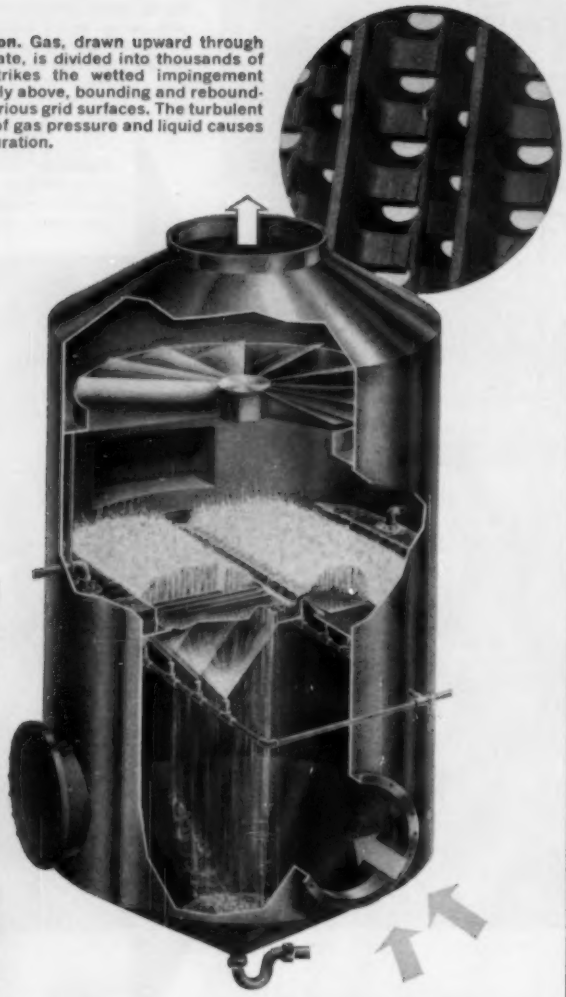
LE ROI STATIONARY COMPRESSORS

SC-09

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

For more facts circle 597 on Reply Card

Jet-swirl action. Gas, drawn upward through perforated plate, is divided into thousands of jets. Each strikes the wetted impingement surface directly above, bounding and rebounding against various grid surfaces. The turbulent intermixture of gas pressure and liquid causes complete saturation.



NEW FROM SINCE 1874 SLY

IMPINJET™ SCRUBBER

High Efficiency... Low Operating Costs

Now Sly brings you the simplest, most effective wet cleaning method known. The new IMPINJET Gas Scrubber assures thorough saturation of particles, even in sub-micron sizes.

There are no moving parts. Complete cleaning results from the turbulent interaction of gas and liquid, as effected by the impingement baffle plate.

Pressure drop and resulting power requirements are low. Liquid consumption is only 1 to 3 gallons per 1000 CFM at 20-40 psig.

The IMPINJET Scrubber utilizes the proven principles contained in the original Harmon patents basic in the development of the impingement plate scrubber. Single-plate units effectively clean gases resulting from a wide variety of industrial processes. Multi-plate units are available for absorption, cooling and extra-high-efficiency applications.

For dust suppression, *wet or dry,* consult Sly — maker of the Dynaclone, the self-cleaning, continuously operating dry dust filter.

Send For New IMPINJET Catalog

THE W. W. SLY MANUFACTURING CO.

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For more facts circle 598 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

unit is claimed to give long service on intermittent or continuous flows of air. No water or electrical connection is required. Wilkerson Corp.

▲ For details, circle 25 on Post Card

More information on any of this equipment can be yours without cost or obligation. Just circle the item numbers on the Reader Service Cards provided on pages 217-218.

PLUNGER PUMP with high volumetric efficiency

Compact design and high volumetric efficiency are attributed to the PT-4 Triplex Plunger Pump operated at 70 hp input at 400 rpm. Suited for waterflood and salt water disposal,

it is designed to fill many needs in chemical, refining and food processing plants. Low pressure range is from 510 to 1563 psi; high pressure range maximum is 3000 psi. Plunger sizes are 3½ to 1¼ in. by 4-in. stroke and plunger load is 4910 lb. Gardner-Denver Co.

▲ For details, circle 26 on Post Card

LIVE ROLLER CONVEYOR reduces accumulation pressure

Reduction of accumulation pressure on commodities to a mere 3½ per cent of commodity weight is announced for this simple, belt-driven live roller conveyor. It is designed to handle a broad range of packages of mixed dimensions and weights without buckling the line of accumulated packages or causing erratic conveyor performance. When an accumulated line of packages is released on this conveyor, the entire line moves forward at the same instant—no gaps or lagging. Belt actuators provide correct, uniform belt pressure against rollers; no manual adjustment is required. The unit needs

where to use gas-fired heaters in plants

Free from Reznor: Our just published handbook, "Industrial Applications of Direct Gas-Fired Heaters," tells all about the profitable use of Reznor heaters in manufacturing plants. Use it to find out the many advantages—and economies, too—of using Reznor unit heaters for comfort heating of work or storage areas. For example, you can spot the heaters exactly where heat is needed, without installing long piping runs from a remote central boiler that may already be overloaded. You can use Reznor Aluminized or stainless steel duct furnaces for tempering make-up air or heating process air. Or use them in year-round heating and cooling systems. (Reznor duct furnaces are A.G.A.-approved for downstream applications.)

Among other subjects covered: How to blanket shipping doors, how to install heaters 40 ft. high to clear craneways; how to use Reznor heaters for stand-by operation on liquefied petroleum gas—with city gas as standard fuel.

Published by Reznor, the world's largest manufacturer of gas unit heaters, the handbook is yours free. Mail the coupon—or, call your Reznor distributor or district office, listed in the Yellow Pages under "Heaters—Unit."

REZNOR HEATERS

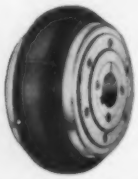
REZNOR MANUFACTURING COMPANY
Department PE-5, Mercer, Pennsylvania
Send me a copy of "Industrial Applications of Direct Gas-Fired Heaters."

name_____ title_____
company_____
address_____
city_____ state_____

For more facts circle 599 on Reply Card

TORQUE-ARM

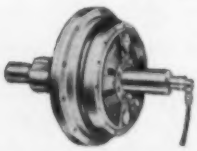
America's most widely used shaft mounted speed reducers!



DODGE PARA-FLEX

The Flexible Cushion Coupling

with the 4-way flex!



AIR-GRIP CLUTCHES

Amazing sensitivity — instant response!

Write for Bulletins!

- Torque-Arm—55 models—complete data.
- Para-flex Couplings—data.
- Air-Grip Clutches—technical data.

DODGE MANUFACTURING CORPORATION
2700 Union Street • Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

For more facts circle 600 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

only 50 per cent of the horsepower usually required for equivalent capacity, accumulating live roller conveyors. It comes in seven widths from 10½ to 38½ in. between frames. Standard Conveyor Co.

▲ For details, circle 27 on Post Card

LIGHT BULB has the ruggedness of safety glass

According to manufacturer, the Flamescent can be dropped onto a hard surface without exploding into a shower of glass; and while in use (and still hot) it can be dipped in ice water without danger of flying glass fragments. Shatterproof characteristics of this incandescent lamp are built in. The bulb consists of a glass shape

wound with Fiberglass yarn. Glass and yarn are bonded into a single unit with a rubbery Dow Corning silicone adhesive. While the Flamescent derives its name from its warm, flame-like glow, its lumen output is higher than that of other processed bulbs. Company says it is glareless and lasts three times longer than conventional lamps. Available in standard sizes, the Flamescent with its weatherproof features is suitable for outside lighting, and in plant areas where the bulb may come in contact with flying sparks, welding slag, hot solder, water. DuroTest Corp.

▲ For details, circle 28 on Post Card

AIR POWER CYLINDERS are economical, compact

General purpose air power cylinders in the Series C, 200 psi maximum, are available in five bore sizes from 1¼- to 4½-in. with standard strokes to 20 in., single and double rod end models. Floating cushions, to reduce impact of stroke, can be furnished or added in the field without increasing overall length. One compact design provides three basic mounting positions: side, cap end or head end. Four mounting attachments can be supplied. Friction is minimized by an oil impregnated bronze rod bushing which keeps rod lubricated. Hannifin Co.

▲ For details, circle 29 on Post Card

SELF-DRAINING VALVE for process applications

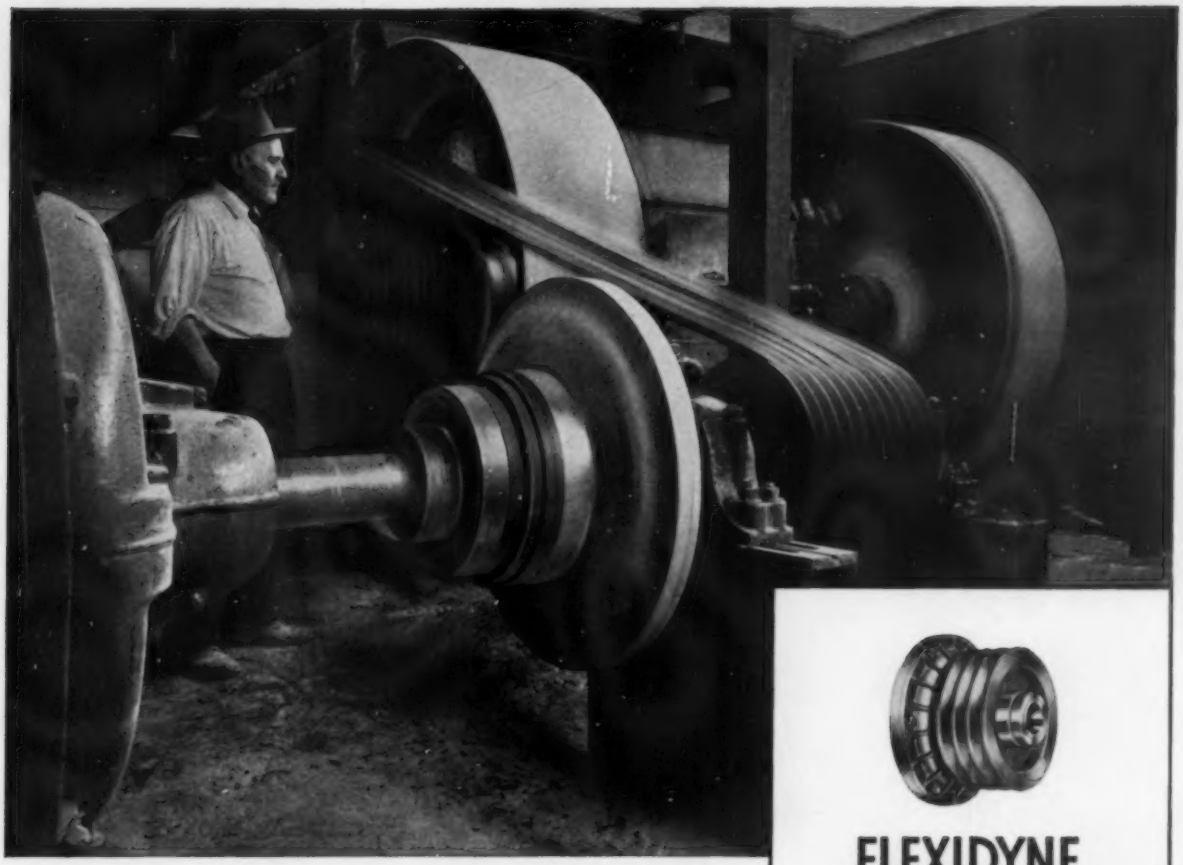
Model 1900 Valve is designed to completely drain the line and valve body of complex fluids, slurries and other flowing media which contaminate or tend to set up and harden in the system. Body and trim surfaces slope downward, making valve self-draining when installed in either horizontal or vertical position. Principal applications are in industries using a batch operation requiring cleaning of system after each batch is run because of fluid contamination, fermentation, toxicity and solidification, and in continuous process plants requiring purging of lines and valves after shut down. The Annin Co., Div., The Worthington Corp.

▲ For details, circle 30 on Post Card

VIBRATING FEEDER carries its own hopper

Model 24S4-125 is 2 ft long with a 1½ cu ft hopper and moves up to 6000 lb of dry granulars per hour. The enclosed tubular steel feeder is described as ideal for handling cement, fly ash and other dusty powders; aluminum and stainless steel models are available for food

products and other materials which must be kept free from contamination. There are no moving parts in contact with material handled. The metal hopper located above the feeder can be attached with a dust-tight flexible boot. An air-powered vibratory drive unit, mounted under the feeder, supplies the force to move the material. Automatic lubrication of its one moving part reduces maintenance. Flow is regulated by adjusting the air supply pressure and can be instantly started and stopped



Look, Folks...No Jolts!

– and no reduced voltage starter!

– no oversize motor!

Introduce Flexidyne into your drive system and your stubborn loads take off smoothly, without the necessity of oversize motors or costly controls. Flexidyne provides the equivalent of a "no load" start, reduces maintenance, protects motors against shock or overload, and operates at 100% efficiency at full load speed!

Across the nation — on jaw crushers as above, on mixers, ball mills, cranes, conveyors, cotton cards — in wire drawing and elsewhere — thousands of Flexidynes are performing brilliantly. Here is the *new and better* way to start loads smoothly!

Flexidyne is available from stock in 8 drive sizes and 10 coupling sizes for capacities to 1000 hp. Ask your Dodge Distributor, or write us for complete technical bulletin.

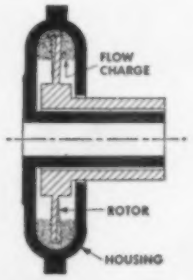
Dodge Manufacturing Corporation, 2700 Union St., Mishawaka, Indiana

FLEXIDYNE

THE DRY FLUID DRIVE

The "fluid" in Flexidyne is heat treated steel shot. A measured amount, called the flow charge, is contained in the housing which is keyed to the motor shaft. When the motor is started centrifugal force throws the flow charge to the perimeter of the housing, packing it between the housing and the rotor which transmits power to the load.

After the starting period of slippage between housing and rotor the two become locked together and achieve full load speed, operating without slip and at *100% efficiency*.



The Products with the Pluses... **DODGE** ***of Mishawaka, Ind.***

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Look under "Dodge Transmissioneer" in the *white* pages of your phone book. Factory trained by Dodge, he can give you valuable assistance.

For more facts circle 601 on Reply Card

Facts of Light!

IT COSTS NEARLY $2.50 TO OPERATE A 25 CENT LAMP

The electric power required to operate a 25 cent 100 watt incandescent lamp will amount to nearly $2.50 before the lamp burns out. The efficiency with which a lamp converts electric power into usable light is an important factor in considering lamp value.

TWO 100's WON'T DO THE WORK OF ONE 200

A 200 watt incandescent lamp produces approximately 3800 lumens. Two 100 watt incandescent lamps produce approximately 3400 lumens — about 10% less light.

YOU CAN CHECK YOUR LIGHTING AGAINST RECOMMENDED LEVELS FOR ALMOST 700 DIFFERENT JOBS

The Illuminating Engineering Society publishes Foot-candle Tables of Recommended Illumination (1958) for seeing tasks in many different categories and industries.

THERE ARE OVER 3,000 TYPES AND SIZES OF CHAMPION LAMPS

More than 3,000 different Champion Lamps are available to satisfy the diversified lighting needs in office buildings, homes, department stores, ball fields, theaters, factories, shops, garages, showrooms, railroads, airports, restaurants, streets, parks, schools, and many other installations.

Your Best Buy in Lamps

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT

For more facts circle 602 on Reply Card

PLANT ENGINEERING EQUIPMENT

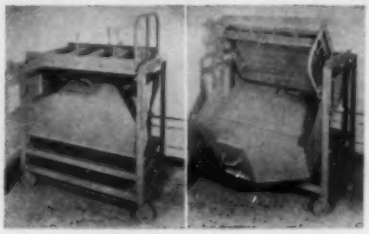
(Begins on page 168)

by a manual or solenoid valve. Completely enclosed, the feeder will operate while submerged in a liquid. The Cleveland Vibrator Co.

For details, circle 31 on Post Card

DUMP CART-HOPPER eases handling of small parts

Handling of small parts during heat treating is simplified by this combination dump cart and hopper. The cart is a dolly with tilting roller platform. A basket load of parts is rolled onto the platform where the basket is

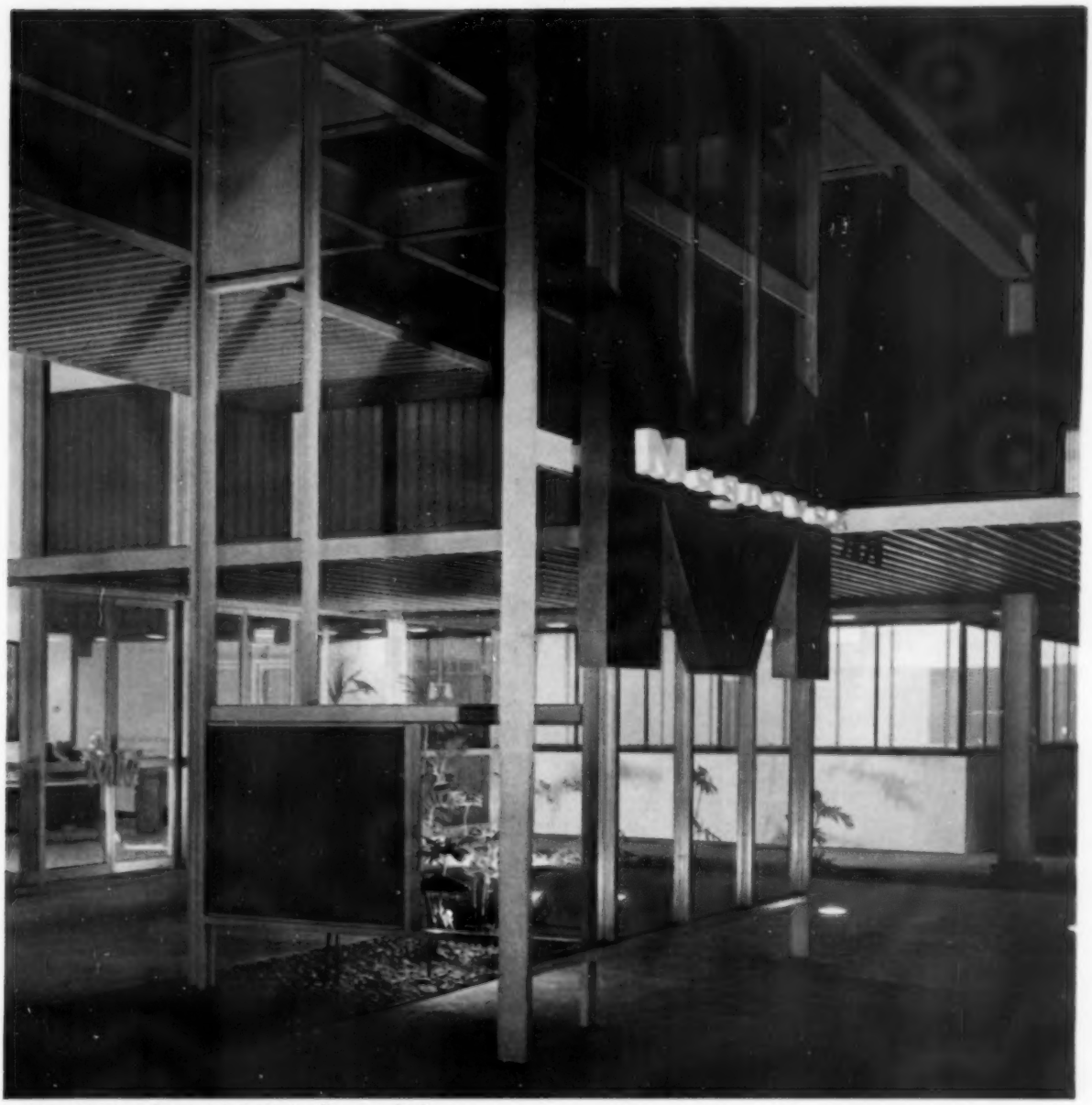


clamped into position. A drain pan under rollers collects excess quenching oil. The hopper chute is then opened and the platform rotated to pour the parts into the hopper, which has an opening at its narrow end for feeding parts into tote boxes. With the hopper chute folded in, the platform can be locked in horizontal position to let the unit serve as a dolly. Mounted on wheels it can be rolled into position for loading or unloading a battery of furnaces. Ipsen Industries, Inc.

For details, circle 32 on Post Card

DRYER processes granular solids with minimum loss

The Fluid-Flo Dryer can be applied in coal, chemical, rock, sand and other industries processing granular solids. It can be modified for use in cooling or roasting operations. Basically, it consists of a housing and a constriction plate over which the material is fed by one or more feeders. Hot drying gases are pulled through the plate, under suction induced by a fan, causing the material to be suspended in a fluidized mass above the plate. The suspended mass flows horizontally across the plate to the discharge chute. A motorized air lock within the discharge chute prevents loss of heat and maintains suction. Exhaust air carries fines through a dust collector and if desired these can be recombined with processed material. Product degradation



Building: Magnavox Research Laboratories, Torrance, Calif.
Architect: Risley & Gould, AIA, Los Angeles, Calif.
General Contractor: William Simpson Construction Co., Los Angeles, Calif.
Alcoa Alumalure Contractor: George D. Widman, Inc., Los Angeles, Calif.
Entrance: Rebco, Inc., Los Angeles, Calif.
Photographer: Ezra Stoller

Because Alcoa gave plant owners lasting color at budget prices, aluminum buildings everywhere can gleam with radiant beauty. Called Alcoa * Alumalure, this tough, baked enamel finish allowed a choice of 11 handsome hues, plus natural aluminum, that helped to make this workaday building an AIA award winner. And with it go all the traditional advantages — faster, easier erection and total freedom from maintenance — that have long made Alcoa first in aluminum construction.

*Registered Trademarks of Aluminum Company of America

Build for Beauty with ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

For more facts circle 603 on Reply Card

"ponbake"

A new finish for Blaw-Knox Grating for better wear—and corrosion-resistance

By the time most grating is erected, much of the normal factory-applied coating is worn off. Unless it is repainted at once, costly corrosion starts to take its toll.

However, "Ponbake," the new epon base, high polymer synthetic paint process, developed by Blaw-Knox especially for grating, stays factory-new almost regardless of the treatment it gets.

This is the most rugged, durable finish available on gratings today. It has greater resistance to wear, abrasion, corrosion, chemicals and weathering than any other. Costs less than on-the-job painting. Write if you would like more information, or ask for a Blaw-Knox Grating salesman to show you a sample.

Free facts on grating. Write for Bulletin No. 2581. Blaw-Knox Company, Pittsburgh 38, Pennsylvania.

BLAW-KNOX

GRATING

BLAW-KNOX

Blaw-Knox designs and manufactures for America's growth industries: METALS: Rolling Mills • Steel Processing Lines • Rolls • Castings • Open Hearth Specialties • PROCESSING: Process Design, Engineering and Plant Construction Services • Process Equipment and Pressure Piping • CONSTRUCTION: Concrete and Bituminous Paving Machines • Concrete Batching Plants and Forms Gratings • AEROSPACE: Fixed and Steerable Antennas • Radio Telescopes Towers and Special Structures • POWER: Power Plant Specialties and Valves

For more facts circle 604 on Reply Card

PLANT ENGINEERING EQUIPMENT

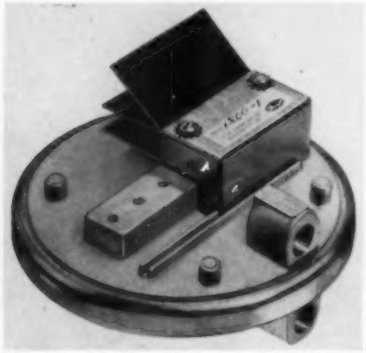
(Begins on page 168)

is minimized because material is retained within the dryer for a relatively short period of time. Folder 2909 describes the Fluid-Flo. Link-Belt Co.

▲ For details, circle 33 on Post Card

LOW COST SWITCH features sensitivity, compactness

No. 1800 Series Differential Pressure Switch is described as a low cost compact (4-in. diam) unit of excellent sensitivity, operating from differential pressures as low as 0.15 in. water with ranges up to 80 in. water. It is designed to hold a set point through

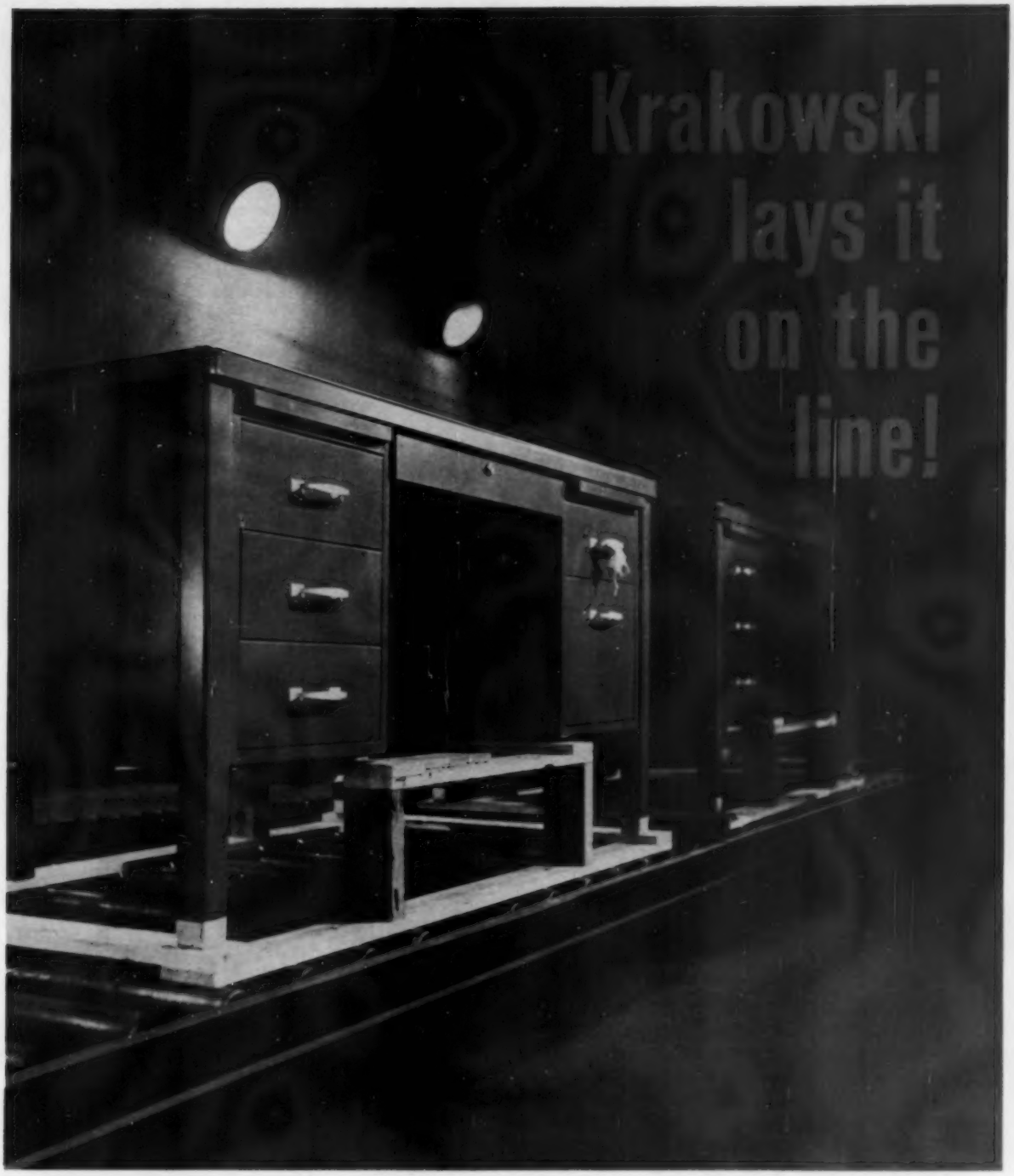


various total pressures and can be operated from plus, minus or differential pressures in any position. Manufacturer says it can be applied almost universally for low pressure sensing and control, such as in cooling coil defrost control, dust collection systems, air filters, air curtain systems. Having few moving parts, the switch is said to be virtually unaffected by severe vibration conditions. Various arrangements are available. F. W. Dwyer Mfg. Co.

▲ For details, circle 34 on Post Card

TRANSFORMER keeps one lamp burning if others fail

Circuiting of the two-lamp parallel mercury transformer provides complete electrical independence between the two lamps, with negligible interaction. Failure of one lamp does not significantly affect operation or light output of remaining one. In practice, the constant wattage design limits starting current during lamp warmup. Lamp wattage and light output are maintained in spite of line voltage fluctuations up to ±13 per cent, according to manufacturer, and lumen output is held constant without ap-



Lou Krakowski, General Superintendent of the Harrison Sheet Steel Company, is a guy who makes no bones about what he wants. It's service! And, for twenty years, he has been getting what he considers the best . . . Cities Service.

Turning out, among many other things, 125 steel desks a day, he wants complete and dependable lubrication service. One of the many Cities Service products he uses to get this job done is Trojan H-2 grease. For general greasing on all equipment, multi-purpose Trojan H grease has a wide range of application. And, because of the variety of jobs Trojan H grease does, it reduces his necessary lubrication stocks.

If you have to *get it on the line* . . . call your nearest Cities Service office . . . or write Cities Service Oil Company, 60 Wall Street, New York 5, N. Y.

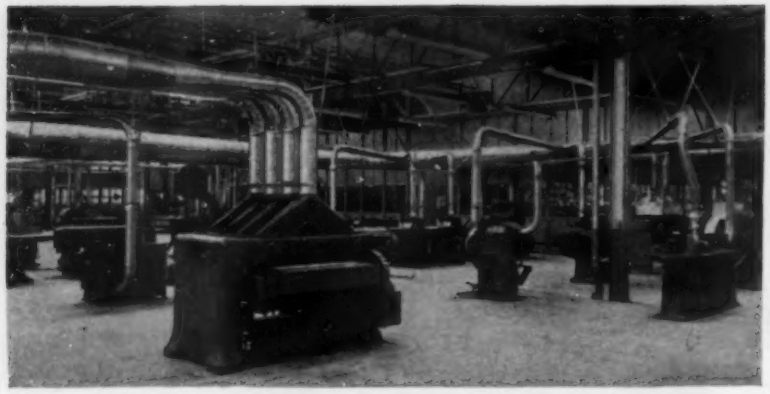
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

For more facts circle 605 on Reply Card

For complete flexibility and expandability . . . exclusive K & B Plenum Main System.

No two dust control problems are alike!



Highly efficient, low cost Tapered Main System, for fixed machine location.

Since no two dust control problems are alike, a Kirk and Blum engineering survey determines the exact nature of *your* specific application. It's all part of K & B's *complete* service to assure you the best system for your particular need, all factors considered.

From survey time until the system is completed and in operation, Kirk & Blum handles the entire job with one undivided responsibility . . . a condition only possible when you have *one* source for all service, *one* guarantee for all components.

Write today for the new 52-page K & B Catalog or a no-obligation survey of your particular problem. The Kirk & Blum Mfg. Co., 3189 Forrer St., Cincinnati, 9, Ohio.

KIRK & BLUM *Complete Dust Control Systems*

For more facts circle 606 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 166)

proximately ±1 per cent. Also, the primary current drops when an open or short-circuit transformer occurs in the lamp circuit, to prevent transformer overheating. Stable lamp operation is claimed. Constant wattage also maintains the open circuit and wattage to the lamps within rated primary range. The two-lamp transformers are available in stock in indoor and weatherproof outdoor designs, in several primary voltages. Sola Electric Co.

For details, circle 35 on Post Card

LITTLE POWER PUMP develops up to 10,000 psi

Model 1729 is a miniature, portable two-speed hydraulic power pump weighing only 14 lb. It incorporates higher volume, low-pressure pumping features which provide fast approach ram action with automatic changeover to low-volume, high-pressure drive. Approximate capacity is 80

cu in. at 30 psi, 20 cu in. at 100 psi, and 4 cu in. at 10,000 psi. The pump develops 10,000 psi intermittent, 6000 psi continuous, and is suggested as a power source for electricians' hydraulic knockout punch drivers, rams, jacks, pullers and systems with similar high pressure, low-volume requirements. It is powered by a built-in 115-v ac-dc universal motor and has built-in two-way control valve. For remote control operation, Model 1729-PO has pendant electrical switch, longer power cord. Greenlee Tool Co.

For details, circle 36 on Post Card

ELECTRIC CORDS offer increased flexing strength

Introduced for use on manufacturer's own reels, these electric cords feature an interior construction designed to withstand greater tension, flexing,

PUMP MAINTENANCE... as simple as this?

A wad of waste is usually all that's needed to keep a Deming pump at top performance for years. Some people don't even bother to wipe 'em!

Dependable Demings save you money in other ways, too. When routine servicing is performed, spare parts inventory is light because Deming parts are standardized and readily interchangeable. Plant expansion is less costly because Deming pumps are designed for adaptation to your growth requirements.

Deming rotary and sump pumps, end suction and vertical immersion process pumps are of special interest to the processing industries. For complete descriptive literature, just mail the coupon.

THE DEMING CO.
548 Broadway • Salem, Ohio

Please send me catalogs on: (type)_____ pumps
for (application)_____
NAME_____
ADDRESS_____
CITY_____ ZONE____ STATE_____

For more facts circle 607 on Reply Card

NOW···GLOBE OFFERS···
two new INTERCHANGEABLE trays
for support of cables, wiring and tubing

★ Engineered for uniform design and easy installation
★ Steel or aluminum construction
★ Complete accessories for SPEEDIER Installation
★ No sharp edges to damage cables
★ Complete interchangeability

Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

Distributors are to be found in all principal cities—consult the yellow pages in your phone book under "Gratings" or "Conduits" for the one nearest you.

109

PRODUCTS DIVISION

The **GLOBE** *Company* MANUFACTURERS SINCE 1914

4016 SOUTH PRINCETON AVENUE, CHICAGO 9, ILLINOIS

For more facts circle 608 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

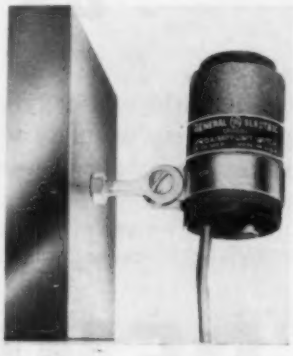
strain, stretch and twist. Individual conductors with Neoprene insulation are so arranged inside the durable sheath that they maintain their position without slipping or stretching, regardless of exterior flexing, extreme stress etc. The sheath also resists abrasion, wear, heat, oil and grease. The cords will be available in standard Nos. 10, 12, 14 and 16 gage with up to eight conductors. Up to 30 conductors can be had in No. 16 AWG. The cords will be standard for replacement use. Gleason Reel Corp.

▲ For details, circle 37 on Post Card

It's easy to obtain product data with the postage-free Reader Service Card provided on pages 217-218. Use them for information on advertised products, too. Just circle the key number appearing at bottom of the ad.

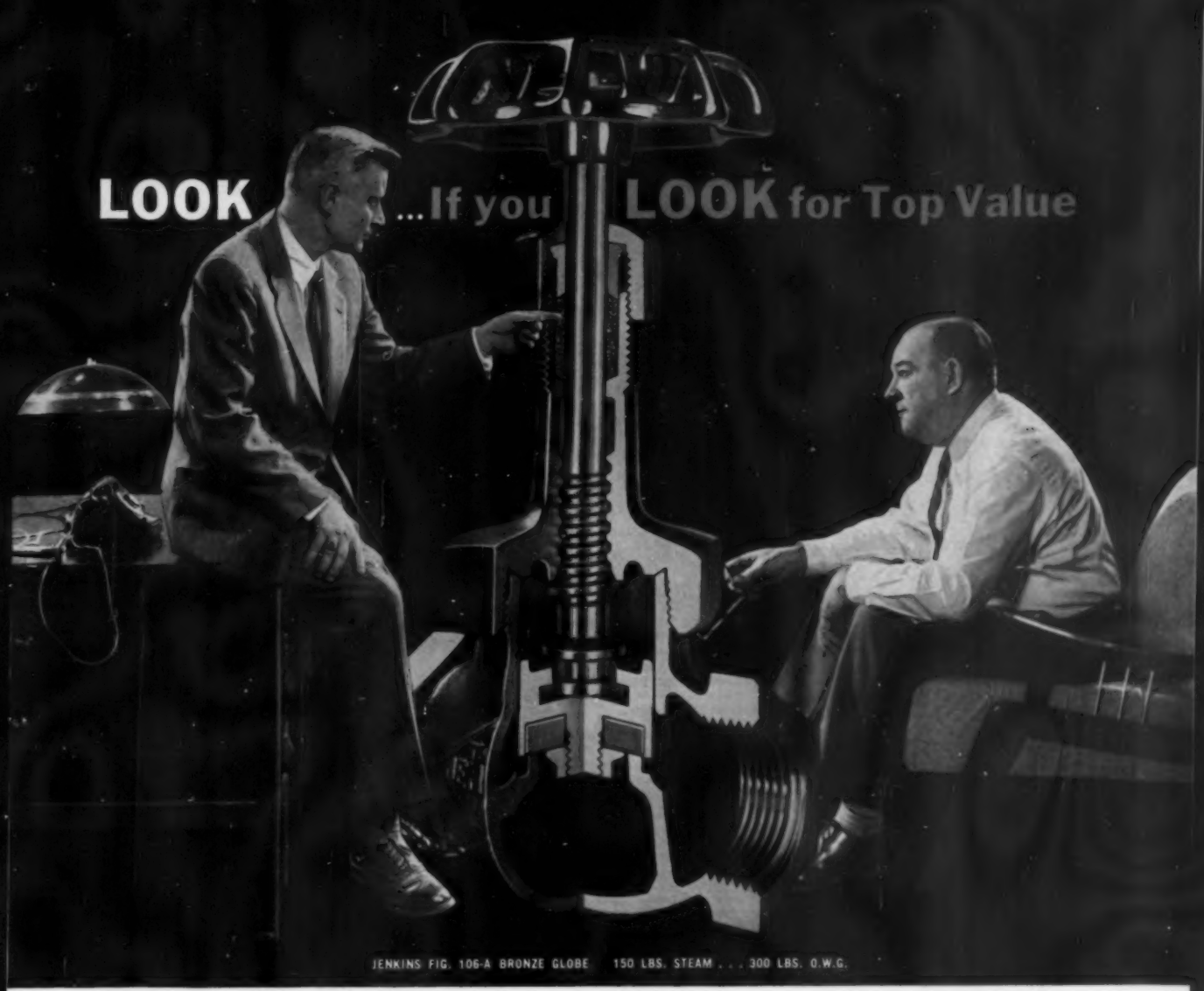
PROXIMITY LIMIT SWITCH
detects any metal

The CR115 D Switch is designed to sense non-ferrous materials up to ½ in. and ferrous material up to 1 in. away. All-transistorized circuitry is self-contained in the operating head. Encapsulation protects internal components of the proximity switch from coolants or contaminants. According to manufacturer, the sensing head will



even operate under water. The switch is rated at 30 v d-c input; 30 v d-c, 250 ma output. Maximum repetitive accuracy is given as 0.005 in.; maximum differential, 0.01 in., and operating time, 20 milliseconds. It will operate in ambients up to 150 F. This

For more facts circle 609 on Reply Card →



JENKINS FIG. 106-A BRONZE GLOBE 150 LBS. STEAM . . . 300 LBS. O.W.G.

in Disc Equipped Bronze Valves

LOOK at that Wheel — Tough malleable iron. Design unequalled for cool, sure grip.

LOOK at the Index Plate — Has Fig. No. etched in green background. Held by wheel nut which is secured by rolled-over spindle end.

LOOK at that Spindle — Made of high tensile bronze. See how much heavier it is . . . how many more deeply cut threads engage bonnet. And, the crowned head that reduces friction on disc holder. Sure, it costs more to make a spindle this way. But it reduces wear, preserves packing, means easier operation.

LOOK at the Packing Nut and Gland—Note the heavy and deep bronze hex. And, that bronze gland designed to compress packing toward spindle.

LOOK at that Packing Box — Its depth equals 1½ times spindle diameter. More packing space means less repacking. An asbestos, lubricated and graphited packing is used.

LOOK at that Bonnet — One-piece, screw-over design with big hex surfaces is easy to remove. Take an extra look at the bevel joint between bonnet and body, serving as an internal brace against the crushing effect of the bonnet assembly. Millions of Fig. 106-A in use for years prove this unique design licks distortion and springing.

LOOK at the Disc Holder — It's the Slip-on Stay-on type originated by Jenkins. Correct protective depth prevents flaking or cracking of disc.

LOOK at the Disc — Easily renewed without removing valve from line. Made of compositions to suit various services . . . and **made by Jenkins**, the only maker of both valves and discs.

LOOK at that Body — Just compare wall thickness of this high tensile bronze body with any other valve. The factor of safety is many times higher than rating requires. See the curved diaphragm to protect seat from distortion by pipe strain. Note that the raised seat is higher to permit more reseating operations . . . and wider, so it won't cut into disc. Pipe threads are full length and clean cut.

LOOK at this . . . for Throttling

—Just replace the standard disc nut with this Throttling Nut and a Fig. 106-A becomes well-suited to throttling service. This unique nut reduces the effects of wire drawing and its long legs restrict flow for accurate control. Many plants take advantage of this versatile valve to reduce valve and parts inventory.

THE FIRST renewable composition disc valve was a Jenkins Valve, originated nearly a century ago. Compare today's Fig. 106-A Bronze Globe with any other. See why so many valve users agree that a *Jenkins* is still the FIRST for top value. For descriptive folder No. 189-B on the full line of Jenkins Bronze Globe, Angle and Check Valves write to Jenkins Bros., 100 Park Avenue, New York 17.

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES

Lifting Made Easy

HOISTS AVAILABLE FOR EVERY LIFTING JOB

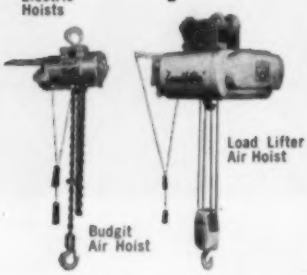
1✓ ELECTRIC HOISTS for frequent lifting with pace setting speed

2✓ AIR HOISTS to lift fast where atmosphere conditions are hazardous, corrosive, extremely hot, dirty or wet

3✓ CHAIN BLOCKS for easy lifting where the work cycle is moderate

P:B Budgit Electric Hoists

Series "700" Load Lifter Electric Hoist



Budgit Air Hoist

Load Lifter Air Hoist

Tugit

Budgit Aluminum Chain Block

Budgit Army Type Chain Block

ELECTRIC HOISTS

P:B Budgit® Electric Hoists. 1/8 to 2 tons. Modern push-button hoists for regular service. Portable. Two fully enclosed automatic brakes. Spotting action is fast, accurate. 1/2-ton load can be lifted at 34 FPM. Hook suspension. Trolleys available. Standard models for intermittent service — AC, DC, and 12-volt battery types — have pull cord control.

Load Lifter® Electric Hoists. 1/2 to 15 tons. For heavy-duty and production line service. Safe 24-volts at the push button. Single and 2-speed control. A ton can be lifted at 60 FPM. Two automatic brakes. Types for lug or hook suspension; also with push, hand-geared or motor-driven trolley. Hi-hook model increases length of lift.

AIR HOISTS

Budgit® Air Hoists. 1/4, 1/2 and 1 ton. Compact, lightweight hoists for regular lifting service. Link and roller chain types. Explosion proof motor. Spark and corrosion resistant link chain models. Speeds infinitely variable to 75 FPM. Pull cord control. Safety hooks standard. Rigid mount type and push trolley available.

Load Lifter® Air Hoists. 1 to 15 tons. Wire rope type for heavy-duty service. Five cylinder motor for smooth operation at all speeds. Speed infinitely variable to 37 FPM. Pull cord control standard; throttle control available. Mechanical load brake adjusts itself. Lug, push trolley, and hand-geared trolley suspension.

CHAIN BLOCKS

Tugit® . . . the Lever-Operated Hoist. 3/4 to 3 tons. Light. Compact. Portable. Operates easily at any angle even in close quarters. Has countless uses in every industry. Spur-geared for highest efficiency. A 42-lb. pull on the handle lifts 2 tons. Spark and corrosion resistant models.

Budgit® Chain Blocks. 1/4 to 10 tons. For production or maintenance. Combine light, strong aluminum frame with spur-geared lifting and automatic load brake. 25 lb. pull on hand chain lifts 1/4 ton. Hook suspension standard. Trolleys available. Army-type Budgit has integral trolley that can be adjusted to fit several sizes of I-beams and permits high hook lift. Ask about spark and corrosion resistant models.

SOLVE YOUR LIFTING PROBLEMS. Call your nearby Shaw-Box Distributor for practical help in selecting the best type of overhead load handling equipment — hoist or crane — for each task. Or, write us for literature.

D

MANNING MAXWELL & MOORE INC. M M & M TRADE MARK

OVERHEAD LOAD HANDLING EQUIPMENT

Products of

MANNING, MAXWELL & MOORE, INC.

Shaw-Box Crane & Hoist Division • Muskegon, Michigan

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.

For more facts circle 610 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

proximity switch may be used with static control or magnetic devices. General Electric Co.

▲ For details, circle 38 on Post Card

LIGHTWEIGHT PUMP makes spray painting economical

Priced under $200, this compact unit brings "no overspray" advantages of airless painting to maintenance work and many medium production operations. It consists of lid, 5-gal. container and handle. The 26-to-1 ratio pump weighs only 17 lb. It handles conventional paints, using a standard air-

less gun fitted with medium product on caps, and operates with air pressure produced by as small as a 1-hp compressor. Available for use with it is a nylon, plastic-covered high pressure fluid hose costing about one-third the price of hose used with larger airless units. Other available accessories include a regulator assembly with gage and blow gun, a material strainer, and hose connection. The DeVilbiss Co.

▲ For details, circle 39 on Post Card

CONVEYOR BELTING woven to stand rough usage

Nylock, a conveyor belt construction developed for superior resistance to heavy impact, accidental damage and mildew, features a solid woven body impregnated with rubber and encased with rubber covers. There are no plies of fabric, and the woven body is claimed to have three times the tear resistance of equivalent strength nylon-filled, multiple ply belt. Nylock is suggested for general industrial use where belt training is difficult, leading to edge damage in many belts. In Nylock, heavy cables of long-staple cotton are interwoven with high-

WHEN THE PROBLEM CALLS FOR PAINT THE BEST ANSWER

IS INVARIABLY **Barreled Sunlight** ENGINEERED Paints

Weather — wet, dry, hot, cold, mild or rugged — sooner or later gets under the skin of even the best buildings. In fact, *no* paint ever completely resists its ravages.

However, over the years in all types of climate, it has been clearly shown that Barreled Sunlight Engineered Paints do a *better* job of resisting the wear and tear of weather than any other paint you can buy. Actual "on-the-wall" tests also prove their measurably greater hiding power which means less paint per job . . . their labor-saving ease of application which cuts costly man-hours to a money-saving minimum.

Your paint maintenance problem may be weather or it may be something else again. In any case, it will pay you to learn more about Barreled Sunlight Engineered Paints.

BARRELED SUNLIGHT PAINT COMPANY
125-E Georgia Avenue, Providence 5, Rhode Island

I want more information on Barreled Sunlight Paints.

☐ Please send me your "Quick Reference Painting Guide" plus your booklet, HOW TO REDUCE PAINTING COSTS.

☐ Please have your representative call me to arrange a free Barreled Sunlight "On-the-Wall" Test.

Name.....

Title.....

Company.....

City..... *Zone*..... *State*.....

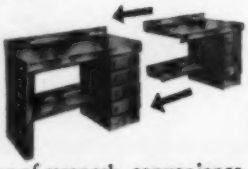
For more facts circle 611 on Reply Card

Buy Equipto -- Industry's choice for Quality Products

COUNT OFF!

you name it...

Equipto can supply you one, or a continuous row of customized benches!



Thru EQUIPTO's ingenious design and method of construction, benches can easily be arranged in one continuous streamlined assembly. Additional EQUIPTO Bench Units are available, less one leg, and are easily bolted to adjoining EQUIPTO Bench. You save money on each additional bench, yet sacrifice nothing in the way of strength, convenience or appearance.

There are 264 models in stock — available with many types and styles of drawers, sliding doors, aerial shelves, and a choice of 12 ga. steel, masonite, laminated maple, or bonded wood tops.

Naturally, all drawers ride quietly on trouble-free nylon rollers. Get EQUIPTO'S complete bench story NOW. Write for complete catalog showing all 264 models.

Equipto

744 Prairie Avenue
Aurora, Illinois

For more facts circle 612 on Reply Card

PLANT ENGINEERING EQUIPMENT

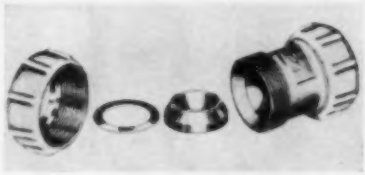
(Begins on page 168)

locked unit. The cotton cables provide strength and bulk. The strands of elastic nylon, running in both directions, lock the cotton cables in place and add strength. Nylock is flexible, suitable for deep-trough idlers. B. F. Goodrich Industrial Products Co.

For details, circle 40 on Post Card

COMPRESSION COUPLINGS for ½- to 2-in. iron pipe

Ease of installation and disassembly, maximum flexibility and " big coupling" principles of design are features claimed for these compression couplings. They have cast malleable iron sleeves and end nuts and wedge-type rubber gaskets. Gaskets are of beveled



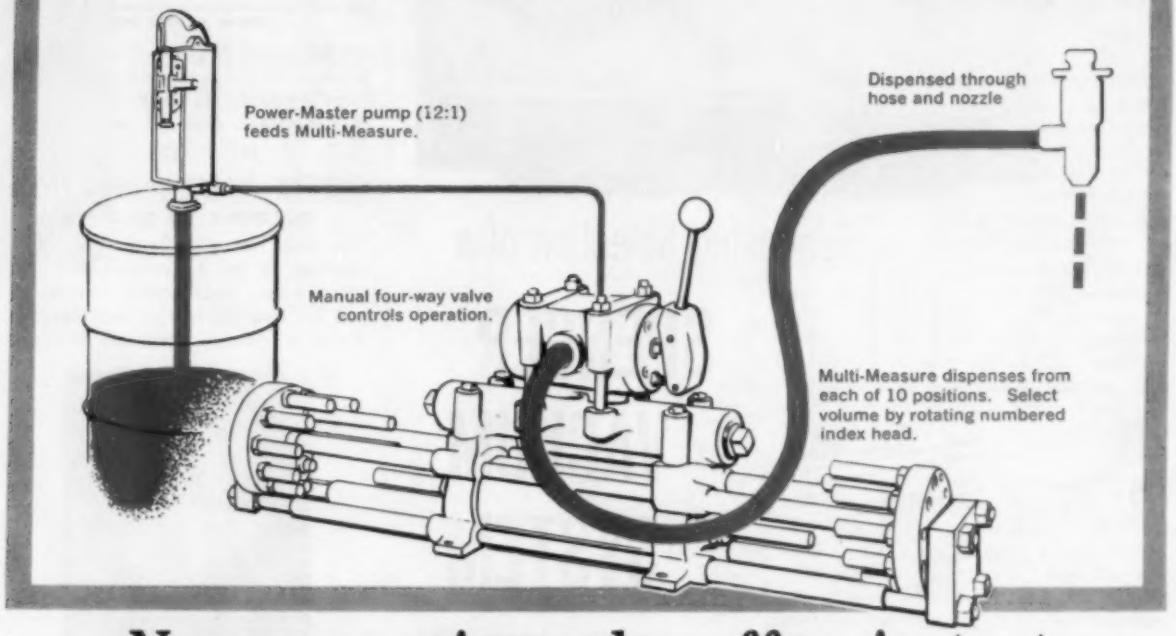
construction so that they draw around the pipe as in large steel or cast couplings, providing effective sealing of new pipe as well as pipe showing considerable deterioration. Couplings are furnished in short sleeve lengths (Type 511) and in long sleeve lengths (Type 512), and are painted with rust inhibiting lacquer or galvanized finish. Smith-Blair, Inc.

For details, circle 41 on Post Card

STEAM CLEANER comes in larger-capacity model

The Malsbary 150 is the same size as the model it replaces (120-130 gph) but pump capacity has been increased to 135-150 gph by redesigning components. Slanted burner creates better flame pattern and improves heating

New ideas for dispensing materials...from LINCOLN


Power-Master pump (12:1) feeds Multi-Measure.
Dispensed through hose and nozzle
Manual four-way valve controls operation.
Multi-Measure dispenses from each of 10 positions. Select volume by rotating numbered index head.

New measuring valve offers instant selection of 10 different volumes

If your dispensing operation requires frequent changes in dispensing volume, you will save time and speed production by using Lincoln's new Multi-Measure Model 83232. Ten adjustable stop pins let you preset the amount each position will discharge with a range of settings from .5 to 25 ozs. The numbered index heads rotate for rapid switching from one volume to another. The system is ideal for filling different mold cavities with the exact amount of material each requires, filling gear cases, sealed bearings and similar applications.

Lincoln offers a complete selection of measuring valves for precision metering and dispensing of fluid and semi-fluid materials. Whatever your requirements for dispensing materials, consult Lincoln first.

LINCOLN MEASURING VALVE SYSTEMS

Model	Capacity (ozs.)	Max. Operating Pressure (p.s.i.)
MULTI-MEASURE		
83232	10 positions .5-25 ea.	1500
SINGLE MEASURE		
81849	.045-1	5000
81741	0-4	5000
82232	4-8	5000
82233	8-12	5000
81914	4-48	750

LINCOLN ENGINEERING COMPANY 16108
Dept. PE-5
4010 Goodfellow Blvd., St. Louis 20, Mo.

Please send literature on the new Lincoln Multi-Measure.

Material to be dispensed is_____

Name_____ Title_____

Company_____

Street_____

City_____ Zone_____ State_____

6108

LINCOLN
ST. LOUIS

LINCOLN
ENGINEERING COMPANY

ST. LOUIS 20, MO. DIVISION OF THE McNEIL MACHINE & ENGINEERING CO.,

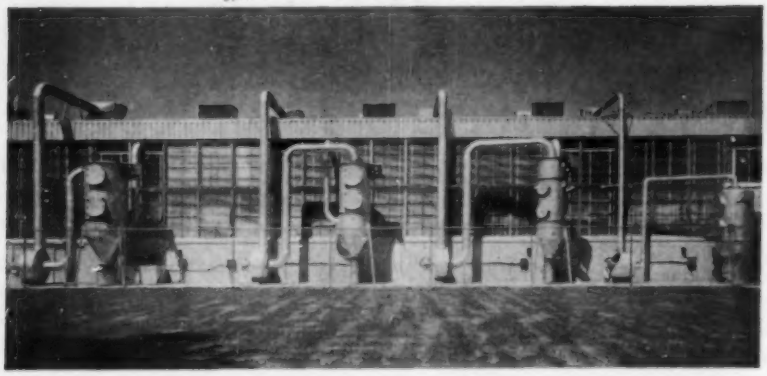
Industry's widest selection of materials dispensing equipment: air-operated pumps—measuring valves—pressure primers—airless spray equipment—hose—couplings—air compressors—filters—regulators

For more facts circle 613 on Reply Card

HERE...Critical Nature of the Application*

...Suggested Selection of a

SPENCER VACUUM SYSTEM



*Machining beryllium poses many serious problems—all related to the toxic nature of beryllium dust.
Recognizing the dangers, Speedring Corp., manufacturers of high precision beryllium instrument parts, specified Spencer vacuum systems which provide:

- ✓ **Pressurized Pickup**—High velocity hoods are tied into the vacuum system at all points where chips or dust are created.
- ✓ **Complete Containment**—Chips and dust are carried off through a "sealed" system . . . cannot escape back into the air.
- ✓ **100% Separation**—Spencer's positive action centrifugal separators—equipped with Cambridge Absolute® filters on the exhausts—assure complete removal of any toxic traces before air is exhausted.

Request catalogs No. 155B "Spencer Vacuum" and No. 143B, "Pneumatic Conveying".

ALSO MANUFACTURERS OF PORTABLE VACUUM CLEANERS

The SPENCER TURBINE COMPANY
HARTFORD 6, CONNECTICUT

For more facts circle 614 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

efficiency, and orifice and nozzle design produces uniform cleaning pattern of large droplets. Malsbary Mfg. Co.
For details, circle 42 on Post Card

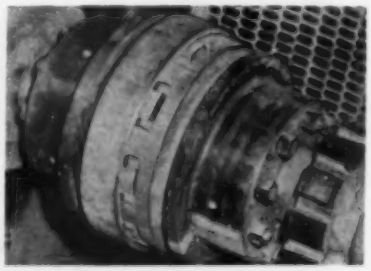
SAFETY RAMP moves floor machines up or down

One man can transfer a heavy floor machine up and down stairs with this safety ramp, manufacturer announces, and it's also handy for truck loading. Ramp is made of aluminum, in light-

weight, easy-to-handle sections. Built-in safety stops serve to hold machines at any point. Two telescoping sections are adjustable to any stairs, up to 15 ft. Extra sections can be added for long stairs. Addition of two-wheel stock truck which rolls on ramp-track increases utility. Orchard Hill, Inc.
For details, circle 43 on Post Card

HEAVY-DUTY COUPLINGS for applications to 8500 hp

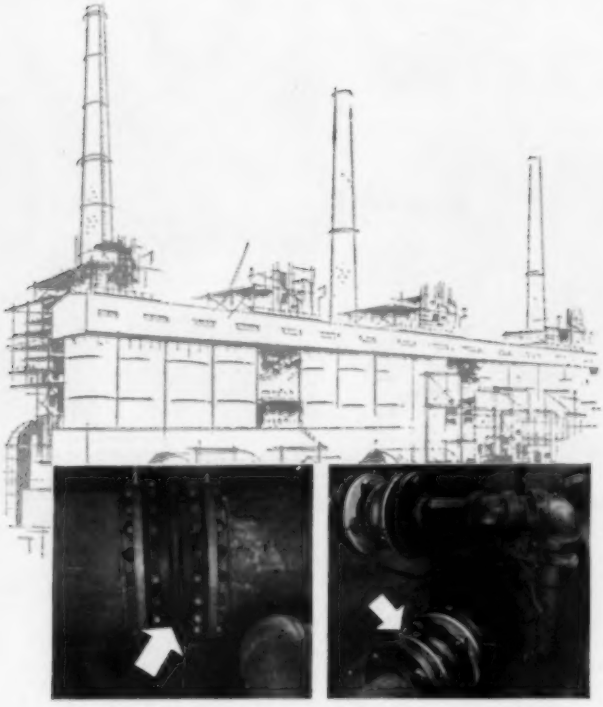
For severe and continuous service the Type H Flexible Couplings incorporate individual load cushions which transfer the entire load, eliminating metal-to-metal contact at the jaws. Shaft connections are made with a



simple alignment procedure, using only a straight edge. The couplings are said to require little maintenance and no lubrication. On non-reversing loads, advancing or reversing load

ENGINEERED PRODUCTS

for Plant Maintenance



Typical installations show Garlock Rubber Expansion Joints on a 26" vacuum condenser inlet (left) and 2½" suction and discharge pipes. Garlock furnishes standard joints from ¾" to 72" in pipe diameter, and in all shapes.

Install Garlock Rubber Expansion Joints. It's good piping practice; here is why:

1. Prevent stresses. Piping systems expand and contract with temperature changes. Garlock Expansion Joints act as a "breather" . . . compensate for expansion and contraction.

2. Eliminate vibration and noise. Pumps, compressors, engines, and pressure surges in pipe lines create vibration and objectionable noises. Garlock Rubber Expansion Joints act as an absorbent cushion . . . reduce vibration and insulate against transfer of noise to other parts of the building.

3. Compensate for misalignment. Piping and mechanical equipment often move out of normal alignment during operation due to wear, load stresses, or settling of buildings. Garlock Rubber Expansion Joints compensate for this and prevent possible breakdowns of equipment. They also make installation easier since alignment of piping and equipment need not be as accurate when expansion joints are used.

4. Reduce flange breakage. Undue stress caused by misalignment, vibration, expansion or contraction of piping or equipment, will break the metal connecting flanges. Garlock Rubber Expansion Joints relieve such stresses.

Offer many application advantages. Garlock Rubber Expansion Joints outlive metal ones; do not crack, corrode, lose shape, or require gaskets. The sturdy construction of Garlock Rubber Expansion Joints results in satisfactory service where pressures are as high as 150 p.s.i., temperatures to 180°F.

Expansion joints are also available for service up to 450°F. In the photo of the joint cut in half, the arrow points to a steel reinforcing ring which, when varied in number with the joint size, provides the extra strength needed for the most severe applications.

For more data, call the nearest of the 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-137, Garlock Inc., Palmyra, N.Y.

GARLOCK

Canadian Div.: Garlock of Canada Ltd.
Plastics Div.: United States Gasket Company.

Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*DuPont Trademark

For more facts circle 615 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

cushions serve to provide double cushion life. Cushions can also be removed without disturbing driving or driven units. The couplings are available with bore sizes to 9½ in. Bodies and jaws are machined electric steel or nodular iron castings. Catalog 61, Section A, gives full data. Lovejoy Flexible Coupling Co.

For details, circle 44 on Post Card

Use the Reader Service Cards provided on pages 217-218 to ask for more information on this equipment. Circle item numbers of products in which you are interested.

ABRASIVE BLADES have reinforcing mesh construction

Leno-Weave fiber glass reinforcing weaves layers of tough, flexible glass cloth into each blade of the MR 824 Break-Resistant Abrasive Blades. The silicon carbide particles flow through

the reinforcing mesh, protruding beyond its surface, protecting the fiber glass cloth from becoming thin from side wear and retaining original break-resistant qualities for life of blade. The MR 824 was developed for cutting lightweight block, dry press refractories, and softer types of stone. The Clipper Mfg. Co.

For details, circle 45 on Post Card

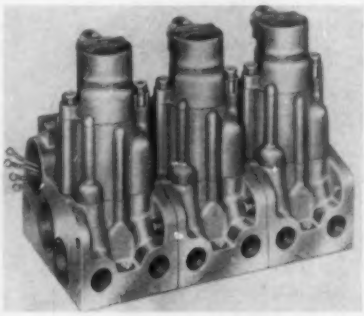
PRESSURE REGULATORS, direct or reverse acting

Featuring a packless valve that permits immediate response to slightest pressure change, these regulators are for use with steam, air, water and gases that are non-corrosive to bronze, iron or Neoprene. They are available in both direct and reverse-acting types, in single- and double-seated designs, sizes from ½ through 2 in. All double seated and larger single-seated valves can be reversed in the field. Valve body is bronze heavy section type for rated pressures to 250 psig. Bulletin 116 gives information. Manning, Maxwell & Moore, Inc.

For details, circle 46 on Post Card

MODULAR MANIFOLD BASE mounts control valves

Featuring common supply, exhaust and wiring conduit ports, these modular manifold bases can be ganged end-to-end to manifold two or more of company's ½-in. PDQ Valves in single, compact assembly. Electrical connections, valve to base, are plug in. Bay-



onet-lock construction of the valve permits removal and installation of valve and pilot assembly in seconds without disturbing piping or wiring. Of cast aluminum, the base has cylinder ports side and bottom tapped ⅜, ½ or ¾ in. NPT. Supply port is tapped both ends and bottom, 1 in.; exhaust and wiring conduit ports are tapped 1¼ in. both ends and bottom. Ganged valves may be piped at either or both ends. Hunt Valve Co.

For details, circle 47 on Post Card

CYCLING TIMER controls multiple-circuit loads

Type 540 Cycling Timer provides timed-sequence control of up to 20 independent load circuits, allows user to choose any of hundreds of cycle speeds from 1 sec to 11 days. "On" and "off" points are independently adjustable for each circuit from 2 to 98 per cent of full cycle time. Unit can be supplied with relay for single-cycle-and-stop operation or with two-speed cam shaft. Timing accuracy is reported within ∓½ per cent of full cycle time at operating points of each circuit. Vernier-type setting dial and adjustable split cams for each load switch provide setting accuracy. Snap-acting SPDT

G-B SNAP*ON DISTRIBUTORS

AKRON, Ohio, The Asbestos Supply Co.
ALBANY, Ga., Industry Insulation Co.
ALBANY, N. Y., Hudson Valley Asbestos Corp.
ALBUQUERQUE, N. M., Mt. States Insulation Co.
AMARILLO, Tex., McDonald Engineering & Insulating Co.
ANDERSON, S. C., Building Material & Equipment Co.
ATLANTA, Ga., Reynolds Aluminum Supply Co.
Parker-Rice Insulation Co.
AUSTIN, Tex., Cinbar Engineering Co.
BALTIMORE, Md., Leroy Insulation Co.
BANGOR, Me., Eastern Glass Co.
BATON ROUGE, La., Eagle Asbestos & Packing Co.
BEAUMONT, Tex., Coburn Supply Co., Inc.
BILLINGS, Mont., Big Horn Supply, Inc.
BIRMINGHAM, Ala., Reynolds Aluminum Supply Co.
Shook & Fletcher Supply Co.
BORGER, Tex., Western Chemical & Supply Co.
BOSTON, Mass., Homans-Kohler, Inc.
BRIDGEPORT, Conn., Robert A. Keasbey Co., Inc.
BRUNSWICK, Ga., Baker Bros., Inc.
BUFFALO, N. Y., Industrial Insulation Sales, Inc.
BURLINGTON, Vt., Pipe Insulators, Inc.
CHAMPAIGN, Ill., The Lewie-David Co.
CHARLESTON, S. C., Baker Bros., Inc.
CHARLESTON, W. Va., Asbestos & Insulating Co.
CHARLOTTE, N. C., D & B Insulation Co.
CHICAGO, Ill., E.C. Carlson Co.
Culberg Asbestos & Cork Co.
CHRISTOPHER, Ill., Hoe Supply Co.
CINCINNATI, Ohio, R. E. Kramig Co.
CLEVELAND, Ohio, Ohio Asbestos & Insulation Co.
COLUMBIA, S. C., Industrial Insulation Div. of Richland Oil Co.
COLUMBUS, Ohio, Santeler Brothers; Culberg of Ohio
CORPUS CHRISTI, Tex., Precision Insulation Co.
DALLAS, Tex., Acme Insulation & Supply Co.
DAVENPORT, Iowa, Republic Electric Co.
DAYTONA BEACH, Fla., B & F Insulation Co.
DECATUR, Ill., The Lewie-David Co.
DENVER, Colo., Plateau Supply Co.
Powers Industrial Insulation, Inc.
DES MOINES, Iowa, Iowa Asbestos Company, Inc.
DETROIT, Mich., The Walter Rankin Co.
ERIE, Pa., Laco-McMullen Co.
EVANSVILLE, Ind., Geo. Koch Sons, Inc.
FALCONER, N. Y., Laco Roofing
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GAINESVILLE, Fla., Baker Bros., Inc.
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GREENSBORO, N. C., Starr Davis Co., Inc.
GULFPORT, Miss., Paine Supply Co.
HONOLULU, Hawaii, Parker Fallis Insulation Co., Inc.
HOUSTON, Tex., Precision Insulation Co.
INDIANAPOLIS, Ind., Lyon Lumber & Supply Co.
JACKSON, Miss., Paine Refrigeration Supply Co.
JACKSONVILLE, Fla., Baker Bros., Inc.
Eckles Distributors, Inc.
Reynolds Aluminum Supply Co.
JOPLIN, Mo., Joplin Cement Co.
KANSAS CITY, Mo., Central Supply Co.
Insulation & Acoustical Specialties, Inc.
Kelley Asbestos Prod.
KEWANEE, Ill., Mechanical Insulation Co., Inc.
LAKE CHARLES, La., Coburn Supply Co., Inc.
Solar Supply Co.
LITTLE ROCK, Ark., Gunn Distributing Co.
LOS ANGELES, Calif., Accurate Insulation Co., Inc.
Western Fibrous Glass Products Co.
LOUISVILLE, Ky., General Insulation & Roofing Co.
MACON, Ga., Industry Insulation Co.
MARIETTA, Ohio, Asbestos & Insulating Co.
MEMPHIS, Tenn., Gibbons Supply Co.
MIAMI, Fla., Reynolds Aluminum Supply Co.
Southern Metal Products Co.
MILWAUKEE, Wisc., F. R. Dengel Co.
MINNEAPOLIS, Minn., Asbestos Products, Inc.
MOORHEAD, Minn., Fargo-Moorhead Insulation Co.
NASHVILLE, Tenn., Reynolds Aluminum Supply Co.
NEWARK, N. J., Eastern Steam Specialty Co.
Robert A. Keasbey Co., Inc.
NEW ORLEANS, La., Eagle Asbestos & Packing Co.
NEW YORK, N. Y., Eastern Steam Specialty Co.
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PORTLAND, Me., Eastern Glass Co.
PORTLAND, Ore., Western Fibrous Glass Products Co.
RALEIGH, N. C., Reynolds Aluminum Supply Co.
RAPID CITY, S. D., Robbins & Stearns Wholesale
RICHMOND, Va., Reynolds Aluminum Supply Co.
ROANOKE, Va., C. E. Thurston Co.
ROCKFORD, Ill., Mott Brothers Co.
SACRAMENTO, Calif., The Brookman Company
SALT LAKE CITY, Utah, Bullough Asbestos Supply Co.
SAN ANTONIO, Tex., San Antonio Machine & Supply Co.
SAN DIEGO, Calif., Western Fibrous Glass Products Co.
SAN FRANCISCO, Calif., Western Fibrous Glass Products Co
The Brookman Company
SAVANNAH, Ga., Baker Bros., Inc.; The Brower Co.
Reynolds Aluminum Supply Co.
SEATTLE, Wash., Western Fibrous Glass Products Co.
SHREVEPORT, La., Frith Sales Co.
SOMERVILLE, Mass., Insulation Products, Inc.
ST. LOUIS, Mo., Refrigeration Supplies, Inc.
The Stovey Company, Inc.
ST. PAUL, Minn., Asbestos Products, Inc.
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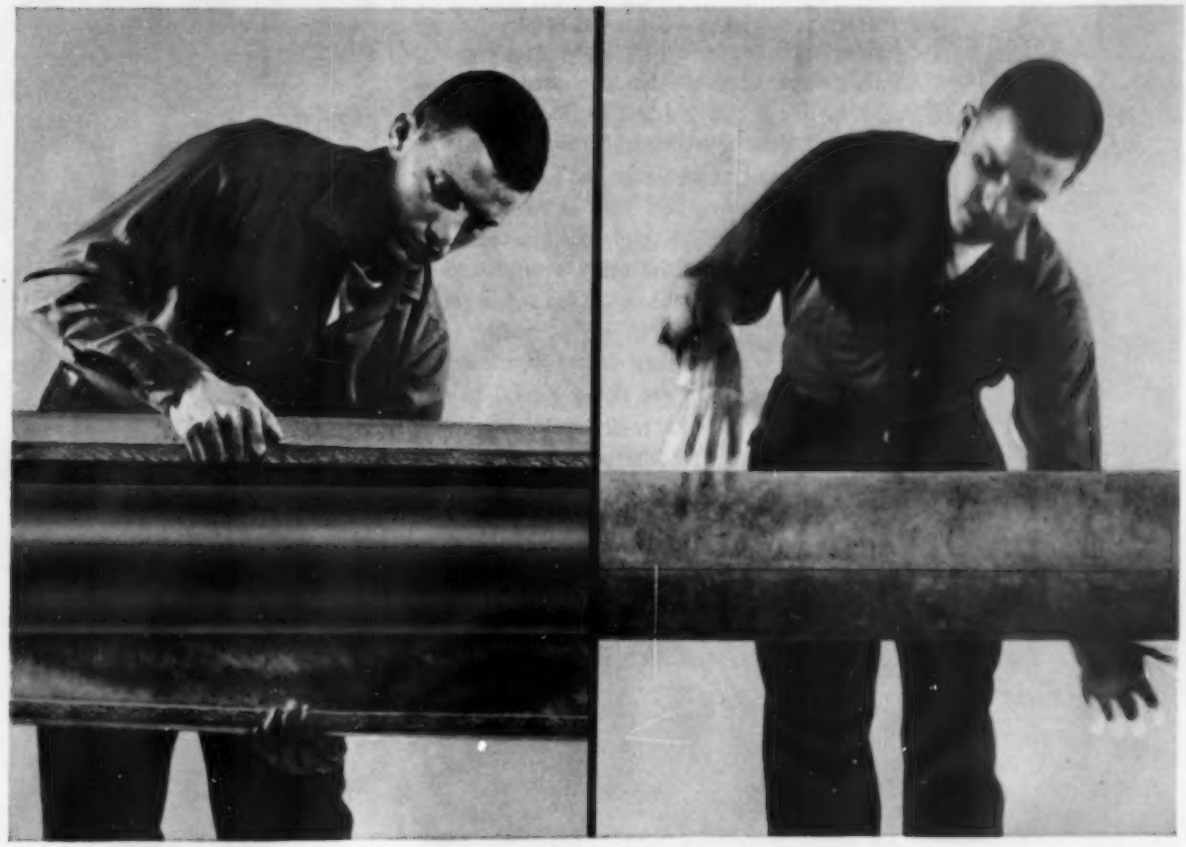
TULSA, Okla., Ball Distributing & Engr. Co.
TUPELO, Miss., Paine Supply Co.
VALDOSTA, Ga., Baker Bros., Inc.
WASHINGTON, D. C., Walter E. Campbell Co., Inc.
WEST PALM BEACH, Fla., Southern Metal Prod.
WICHITA, Kans., Wichita Sheet Metal, Inc.



Cut installation costs up to 50% with G-B SNAP*ON®

Simply spread G-B Snap*On open at the seam, slip over the pipe and let it snap shut—that's how easy it is to cut installation time in half with G-B Snap*On. The highly resilient glass fiber construction of this one-piece pipe insulation (in sections up to 6′ in length and up to 36″ IPS) insures a snug fit with the seams tightly butted together.

G-B Snap*On's ability to provide maximum protection against heat loss or gain is second to none among all general purpose pipe insulations. In fact, G-B Snap*On requires less insulation thickness than most other pipe coverings to provide the same insulating efficiency. Any way you look at it, you save time and money with G-B Snap*On.

WRITE FOR COMPLETE INFORMATION TODAY.

GUSTIN-BACON *Manufacturing Company* gb

232 W. 10th St., Kansas City, Missouri

Thermal and acoustical glass fiber insulations . . . Molded glass fiber pipe insulation . . . Couplings and fittings for plain and grooved end pipe

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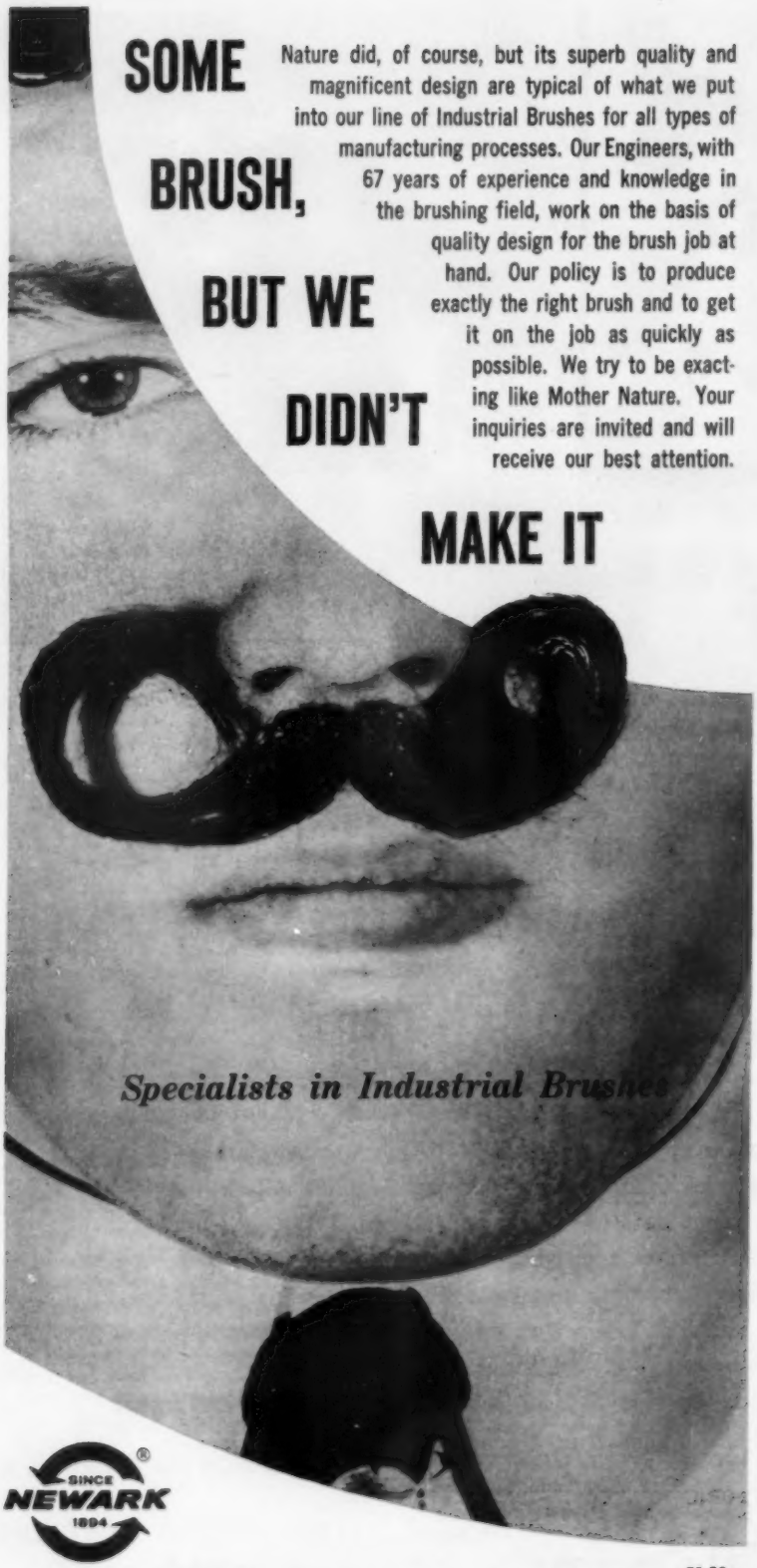

SOME
BRUSH,
BUT WE
DIDN'T
MAKE IT
Nature did, of course, but its superb quality and magnificent design are typical of what we put into our line of Industrial Brushes for all types of manufacturing processes. Our Engineers, with 67 years of experience and knowledge in the brushing field, work on the basis of quality design for the brush job at hand. Our policy is to produce exactly the right brush and to get it on the job as quickly as possible. We try to be exacting like Mother Nature. Your inquiries are invited and will receive our best attention.
Specialists in Industrial Brushes
SINCE
NEWARK
1894

59-56

Leadership Proved Through Performance!

NEWARK BRUSH COMPANY

260 MICHIGAN AVE., KENILWORTH, N. J.

For more facts circle 617 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

switches rated 10 amp at 115 v, non-inductive, are independently mounted, replaceable in field. Motors are available for operation on standard voltages at 50 or 60 cps, 115 v at 400 cps, and 6 to 28 v d-c. Bulletin 540 gives full information. Electromechanical Div., Cramer Controls Corp.

▲ For details, circle 48 on Post Card

PRECIPITATOR has flat collector plate

High collection efficiency of this electrostatic precipitator is attributed to flat collector plate design with "pockets" which trap and hold dust, reducing chance of re-entrainment. Non-welded, roll-formed plate construction minimizes possibility of warping and produces optimum flatness. Unit is cus-

tom built to suit the job and features modular construction. Other advantages noted include improved clean plate sparking voltage, increased migration velocity of dust particles to collecting electrode, better performance with high resistivity dust, less turbulence. Four types of high voltage rectifier are available: silicon, selenium, high voltage vacuum tube or mechanical. Control can be either a saturable reactor, a monocyclic network or a resistor type, with full automation on any of these options if desired. American-Standard Industrial Div.

▲ For details, circle 49 on Post Card

BUTTERFLY VALVES for pipes from 2 to 18 in.

Rated at 150 lb water pressure, these butterfly valves have nickel-plated cast iron or cast steel bodies with stainless steel trim. For special applications, alternate materials are available on some models. Valves in-

ONE OF A SERIES OF CHATS ABOUT THE CONSERVATION AND CONTROL OF HEAT

SARCO TOPICS

STEAM CONSUMPTION WAS ERRATIC AT THE SHERATON-ATLANTIC

This is a documented steam story, and if you have the *least* interest in reduction of steam costs you'll read on. The events took place in the laundry and dry cleaning department of the Sheraton-Atlantic Hotel in New York, which purchases district steam; but they could have happened in *any* steam using establishment — including your plant.

This documentary is concerned with money — (their steam bills for laundry and dry-cleaning were tremendous) and how the Sheraton cut the bill $8500 in one year. That's giving away the climax, but not the plot. To begin with, the Sheraton engineering department kept a daily log which revealed excessive steam costs and startling discrepancies. For example, on one day, 44,000 lbs. of district steam were metered and 20,300 pieces finished. On another day, 38,000 lbs. of steam were metered and 23,300 pieces finished. Clue: This ratio was obviously cockeyed!

To relieve your suspense, we can tell you that the Sheraton removed competitive bucket traps and installed around fifty Sarco Thermo-Dynamic Steam Traps, Type TD-50, on the discharge side of each piece of steam heated equipment, and on drips on supply mains between meters and equipment, as recommended by Sarco. The results were dramatic. (Strong men didn't weep, but they did clap their hands a bit.) In the pre-Sarco December, 868,000 lbs. of steam were purchased for $1725. In the post-Sarco December, only 532,000 lbs. of steam were purchased, for $1025. And the volume of work had increased!

There are no crystal gazers on the Sarco staff; lots of competent engineers, though. These steam detectives find inefficient steam trapping at the bottom of countless high cost mysteries. Sad part of it is, the high cost of steam is only part of the story. Inefficiency in trapping can create other costly problems, too.

We talk a lot about our Thermo-Dynamic trap, don't we? So do other people. In fact we're quite used to grateful cheers of appreciation. Why don't you get the full story, by asking for it? Phone, telegraph, mail—choose your favorite medium of communication.

SARCOTROL! OUR WORD FOR SOMETHING SPECIAL IN TEMPERATURE CONTROL

It may be just what you've been looking for. We don't know. It's rather unusual. We know what it can *do*, but we still don't know everyone who needs it, even though we've been selling Sarcotrol successfully for many years to the plastic fabricating industry. New people we never heard of keep popping up saying it's just what they've needed.

When we designed Sarcotrol we planned it for specific use as a heating and cooling unit for injection molds, cylinders, rolls and drums. What surprises us is that so many different kinds of other equipment are evidently now in search of just such a control, from Banbury mixers to electric coffee pot testers.

The Sarcotrol is a portable, automatic temperature control system utilizing closed recirculation of the heat transfer fluid, to insure even temperatures throughout the equipment being heated and/or cooled. Here's the operating principle. Btu's are supplied to or removed from the rapidly moving high-pressure, high temperature fluid; the variations between delivery and return temperatures being held to a very narrow segment of the Sarcotrol's wide temperature adjustment range. A broad range of flow rates is available to handle widely varying heating and cooling loads, while maintaining tight control of temperatures across the equipment. The basic control mechanism is our own electric indicating controller. Four

standard, fully adjustable, working temperature ranges, cover all heating or cooling requirements between 0° and 300°F. (Keep reading . . . you can always go back for details.) On start-up, full heater capacity is available, and when circulating water approaches control point, heat input is automatically reduced for closer control. Temperature control instruments are automatically compensated for ambient temperature variations.

Heard enough? If not, you must feel a responsive chord vibrating, so write for details. There's literature available which contains much more information than we can give you in this chat.

OUR NEW PUBLICATION IS PRACTICAL—PLUS

SARCOSCOPE is our new house magazine into which we pour what we hope will be a useful mixture of ideas, case histories, tips, facts, news, and sense — both common and uncommon. If you are not receiving

it, we'll be happy to send future issues to you. Just send your name and address. Sarco publishes it as a service to people interested in the conservation and control of heat. We try to keep it down-to-earth, practical and useful.

SO YOU THINK YOUR PROBLEM'S UNIQUE?

Lots of hot water and steam is being wasted these days, in lots of ways. If your eyes glaze as you watch your steam bills mount or shut down your equipment for maintenance, you probably wonder what you did to deserve such problems. If it's any consolation, it's very unlikely that you are alone in your misery. The chances are excellent we have solved just such a problem already for plants similar to yours. Try us. Describe your problem in a letter. We'll probably be able to send you a set of Sarco Case Histories, describing how other plants were able to conquer problems like yours.

5897

SARCO

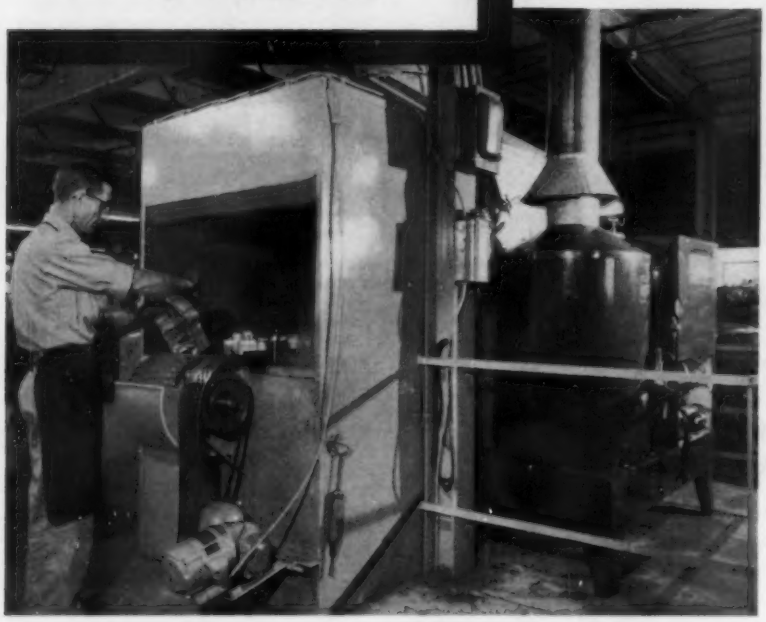
SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

For more facts circle 618 on Reply Card

Cuts cleaning time from 1¾ hours to 15 minutes

Gravely Tractors, Inc., Dunbar, W. Va., mounts one cleaning gun of Malsbary 230 steam cleaner 12" above stainless steel conveyor belt, the other 12" beneath belt, and runs castings between them.



Degreasing and air blasting to get rid of oil, grease and machine grindings on crank cases—handled 60 at a time—just took too long. Then Gravely Tractors installed a 2-gun Malsbary 230 steam cleaner, which degreases and thoroughly cleans castings in 1/7th the time formerly required.

PLACE CLEANER WHERE YOU WISH

...adjacent to work, or 100 to 200 ft. away. This option is yours because the Model 230 is equipped with nozzle control with which operator starts and stops solution flow by squeezing and releasing his grip on hand gun. The Gravely installation is in the assembly area, where solution flow is controlled automatically. Cleaner occupies only 63" x 36" floor space.

Model 230 delivers 180 gph at 60 to 100 psig without smoke, soot or fumes. Thermostat holds solution temperature to within 5° F. of setting. Complete range of Malsbary models for phosphating, production cleaning and maintenance.

MALSBARY

Malsbary Manufacturing Co. • 845 92nd Ave., Oakland 3, Cal.

Malsbary Manufacturing Co. / 845-92nd Ave., Oakland 3, Calif. 152

I would like ☐ Industrial Steam Cleaning portfolio; ☐ Phosphating Manual; ☐ Personal consultation on cleaning problems.

Name_____ Position_____

Company_____

Address_____

For more facts circle 619 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

corporate O ring seals, need no lubrication. In lever operation, they open or close in a quarter turn. Gear operation is optional in larger sizes. In diameters up to 6 in., the valve may be had as an integral unit. In the full range of sizes, the valve is a separate element with interchangeable bolt-on flanges for screw, weld, flange or groove installations. These valves are claimed particularly suited to new installations because their light weight and compact design eliminate need for additional line bracing. As a replacement, the flange end butterfly valve fits exact horizontal space occupied by comparably rated gate valves. Vertical dimensions are less. Lunkenheimer Co.

▲ For details, circle 50 on Post Card

INSTRUMENT designed for ultrasonic nondestructive testing

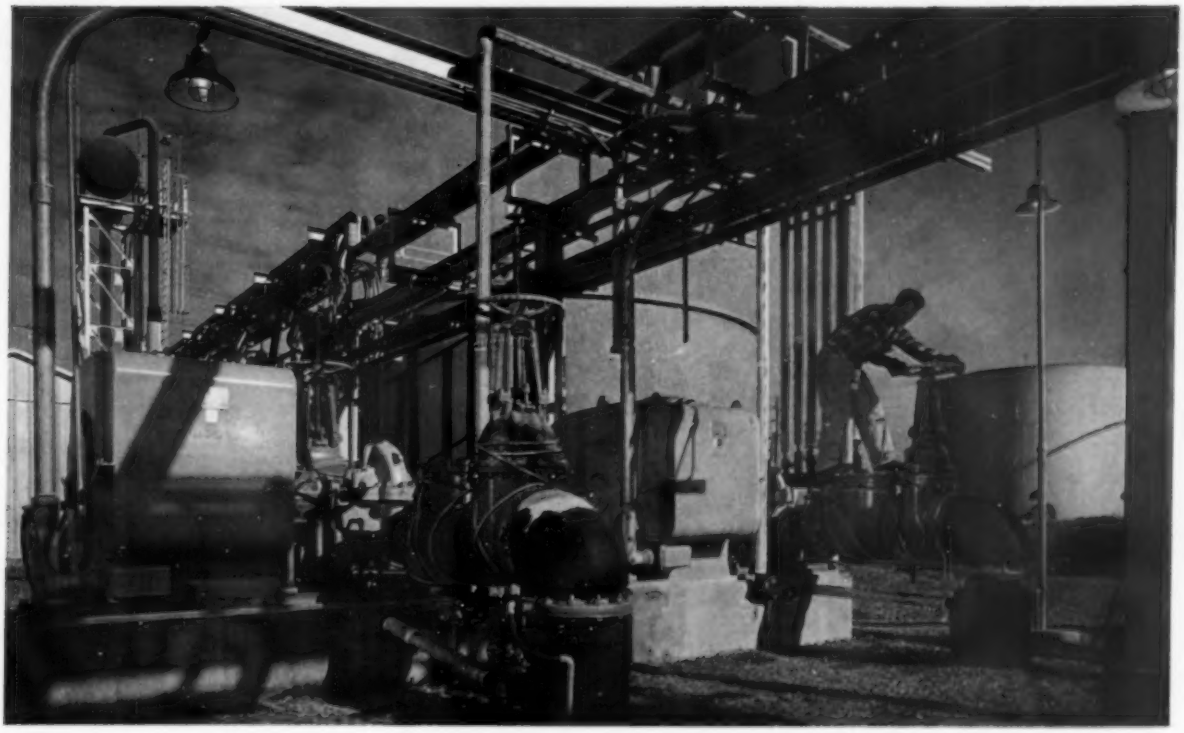
The Immerscope, Model 424-D, is used for ultrasonic nondestructive testing of plates, ingots, pipe, tubing, forgings, castings, welds, rolled shapes, honeycomb, extrusions, as well as other reasonably elastic materials such as glass, hard rubber, ceramics.

Features include: built-in facilities for high-sensitivity, high-resolution contact testing, variable pulse repetition rate, high speed flaw alarm circuit. Princeton Div., Curtis-Wright Corp.

▲ For details, circle 51 on Post Card

MOTOR STARTER with built-in safety features

This combination magnetic starter with double-door dead-front construction is designed to discourage unauthorized entry. For normal maintenance, the main door can be opened with a screwdriver, with circuit



For Corrosion Protection In Depth . . . *Call The* TRUSCON MAN!

Wherever plant and equipment are subject to critical acid, alkali or solvent exposures, high humidity, severe weathering, fumes and gases – or any combination of these–your first step should be to call the Truscon man.

Truscon will provide you with guidance in proper surface preparation, coating application, and inspection. Truscon will also present you with a detailed, written specification on protection of steel, iron, aluminum, concrete and other surfaces–interior and exterior.

Truscon, with a background of over fifty years in successful corrosion control, makes its services available to plant management, engineers and contractors for purposes of plant survey and specification of protective coating systems.

For a detailed description of the principal Truscon protective systems, and how they serve you, mail the coupon below for your copy of Truscon Corrosion Control Bulletin 9111. And, take advantage of a corrosion control specialist's services. Call the Truscon man!

FREE!

Truscon Corrosion Control Bulletin 9111 . . . yours without obligation. Mail coupon now.

TRUSCON Laboratories

DIVISION OF DEVOE & RAYNOLDS COMPANY, INC.

TRUSCON LABORATORIES,
1740 Caniff, Detroit 11, Michigan

☐ Send Truscon bulletin 9111 ☐ Send the Truscon man

Name _____ Title _____

Firm _____

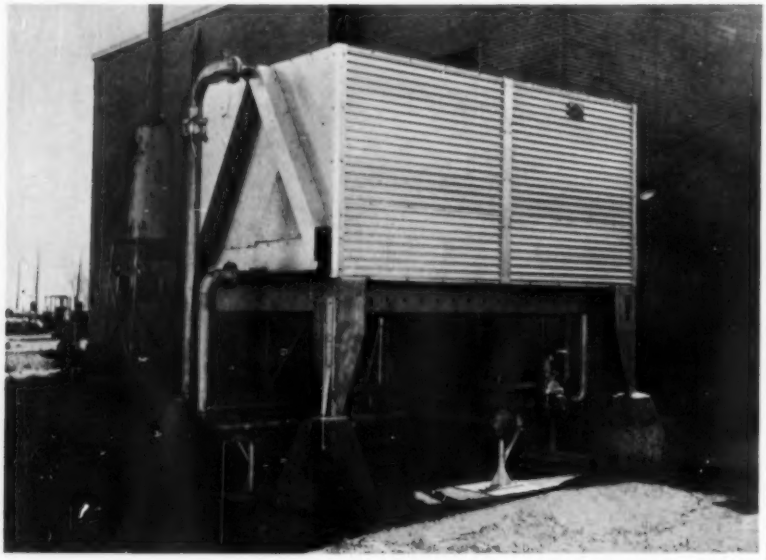
Address _____

City _____ Zone _____ State _____

For more facts circle 620 on Reply Card

NEW ECONOMY
NEW FLEXIBILITY *in*

Closed Circuit Cooling



Marley

DriCooler® Fluid Coolers

Marley DriCoolers have become the modern approach to closed-circuit cooling of recirculated clean fluids by air . . . because they keep costs and temperatures under *complete control.*

DriCoolers are specifically designed to meet industry's varied needs for high level cooling at low costs. They are engineered to combine a high standard of heat transfer capability with economical use of applied horsepower, long service life and conservative first cost. DriCooler controls provide automatic operation in all seasons, in any climate.

This combination of positive characteristics makes DriCoolers the logical cooling equipment for modern machines and processes —engine jacket water . . . electronic tubes and data processing equipment . . . furnace doors . . . molding and extruding equipment . . . air compressors . . . welding equipment . . . anodyzing tanks . . . quenching baths . . . transformers . . . many process requirements.

For complete details on DriCoolers—or on Marley's complete line of water cooling towers—see your Marley engineer or write direct. You'll find that Marley helps you make the most profitable use of your logical cooling medium, whether it be air or water.

Ask for Bulletin DFC-61.

the Marley company

Kansas City, Missouri

For more facts circle 621 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

breaker (or disconnect switch) in "off" position. An additional screw must be turned for entrance to enclosure with breaker in "on" position. In "off" position, and with main door open, breaker can be turned "on" only if a defeater mechanism is depressed —protecting maintenance personnel

against power being accidentally turned on while they're working.

The dead-front panel covering the breaker may be opened with breaker in "off" position by loosing a captive screw. With breaker in "on" position, you must operate another defeater mechanism in the switch handle before the dead-front panel will open. Authorized personnel may padlock the operating handle on the starter in "off" position and the entire enclosure may be padlocked—but the handle cannot be padlocked in "on" position. The starter consists of a magnetic motor starter, control transformer and branch circuit protective device (circuit breaker or disconnect switch). It comes in a NEMA Type 12 enclosure. Sizes 1 and 2. General Electric Co.

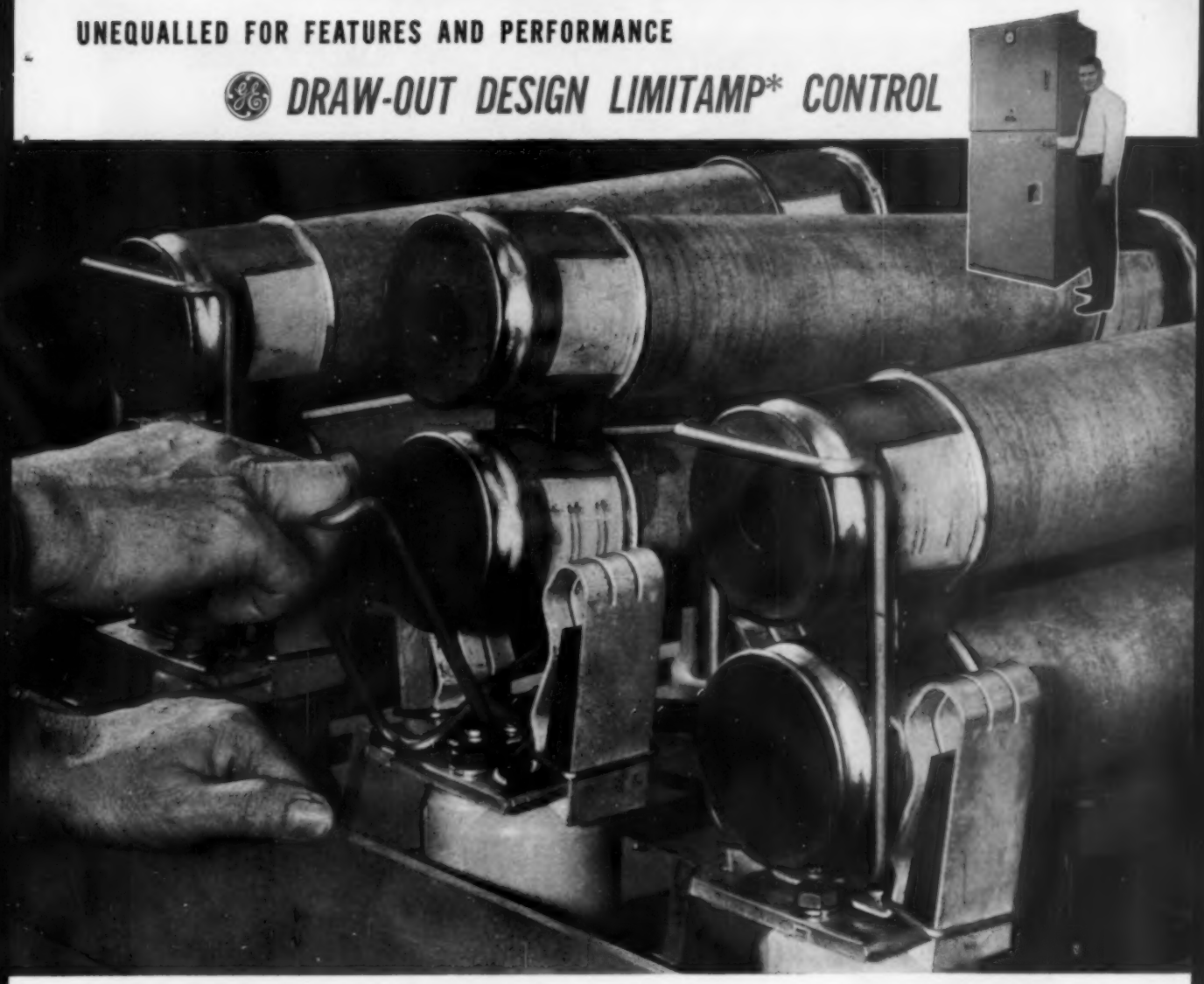
▲ For details, circle 52 on Post Card

WET SCRUBBER maintains high scrubbing efficiency

The Hydro-Volute Scrubber is a variable-orifice unit with air volume control. It develops high scrubbing efficiencies on a wide range of fumes, dust and odor problems despite substantial variation of air or gas flow, and it is not limited by high moisture or temperature conditions of the effluent gas. Both manual and automatic air volume controls are available. In the automatic models, changes in air flow are detected by a differential pressure switch which actuates the modulating control. The scrubber is claimed to compensate for

UNEQUALLED FOR FEATURES AND PERFORMANCE

DRAW-OUT DESIGN LIMITAMP* CONTROL



INTERRUPTS IN 1/2 CYCLE

...protection when you need it—with Limitamp control

Here is performance you can count on ... to start, stop, and protect your motor under *your* environmental conditions!

General Electric's draw-out Limitamp control, rated 2300- to 4600-volts for a-c motors up to 3000 hp, interrupts in the first ½ cycle. Current is limited in the first ¼ cycle. EJ-2 fuses—the standard of excellence—give you this dependable short-circuit protection.

Performance of the draw-out contactor is outstanding under all load conditions—from small motors running light to large motors at "locked rotor." A new blow-out structure and an improved arc chute with superior extinguishing action provides this improved performance. What's more, the new Limitamp contactor meets a 60-kv base impulse level.

Complete design coordination and exhaustive testing in General Electric's high voltage laboratories of bus, cable, current transformers, contactors, fuses, insulators, and overload relays means top protection for men and equipment!

Ask your G-E sales representative about other advanced-design operation, installation, and maintenance features of new Limitamp control. Or, write today to Section 783-26, General Electric Company, Schenectady, New York for descriptive Bulletin GEA-6893.

Industry Control Dept., Salem, Va.

* Reg. Trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more facts circle 622 on Reply Card

NEW YD-SERIES
DOUBLE-ACTING, 10,000 P.S.I.
50, 75, 100, 150 TONS, HEAVY DUTY
BORES: 3¼", 4½", 5⅛", 6⅛"

NEW YDS-SERIES
DOUBLE-ACTING
10,000 P.S.I., 8, 15, 25 TONS
BORES: 1½", 2", 2½"

CENTER HOLE

NEW YDT-SERIES
DOUBLE-ACTING
10,000 P.S.I.
17, 30, 50 TONS
BORES: TWO 1½",
TWO 2", TWO 2½"

CENTER HOLE

Y-SERIES
SPRING RETURN
10,000 P.S.I.
17½, 30, 50,
100 TONS

YS-SERIES
SPRING RETURN
7-9,500 P.S.I.
2, 4, 7, 10, 20,
50 TONS

New OTC 10,000 p.s.i. Hydraulic Cylinders

- PRECISION BUILT, POWERFUL, COMPACT, LIGHTWEIGHT
- THE FIRST ADVANCES FROM OTC'S NEWLY FORMED "PRECISION HYDRAULICS DIVISION"

OTC 10,000 P.S.I. hydraulic cylinders open new possibilities in "hi-pressure" designing by meeting high force requirements with compact, lightweight components. Cylinders are precision built for dependable, continuous performance. Choice of stroke length and standard or tie-rod extension mountings for YD, YDS and YDT series cylinders. Requests for quotations invited.

New two-stage and single-stage 10,000 P.S.I. hydraulic pumps and power packages also available.

WRITE FOR FREE ENGINEERING DATA FILE CATALOG

PRECISION HYDRAULICS DIVISION
OWATONNA TOOL CO.
446 Cedar St. • Owatonna, Minn. • Cable: TOOLCO

RESEARCH · ENGINEERING · DEVELOPMENT
OTC

DESIGNERS AND MANUFACTURERS OF QUALITY HIGH PRESSURE HYDRAULIC COMPONENTS

For more facts circle 623 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

changes in air flow up to 35 per cent from original design capacity.

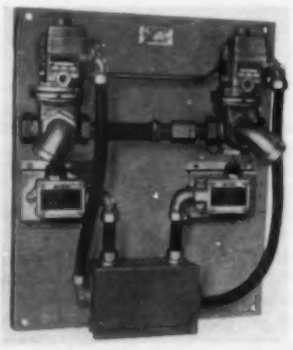
High efficiencies—reportedly up to 99 per cent on materials as fine as fly

ash—are obtained from scrubber action achieved by the counter flow of gas and water, producing a vortex in a series of chambers. The Hydro-Volute Scrubber requires little space. A 1000-cfm unit is the size of an office file cabinet including the moisture extractor on the top. Capacities range from 1000 to 60,000 cfm. Constant or intermittent removal of sludge can be accomplished manually, hydraulically or mechanically. The Johnson-March Corp.

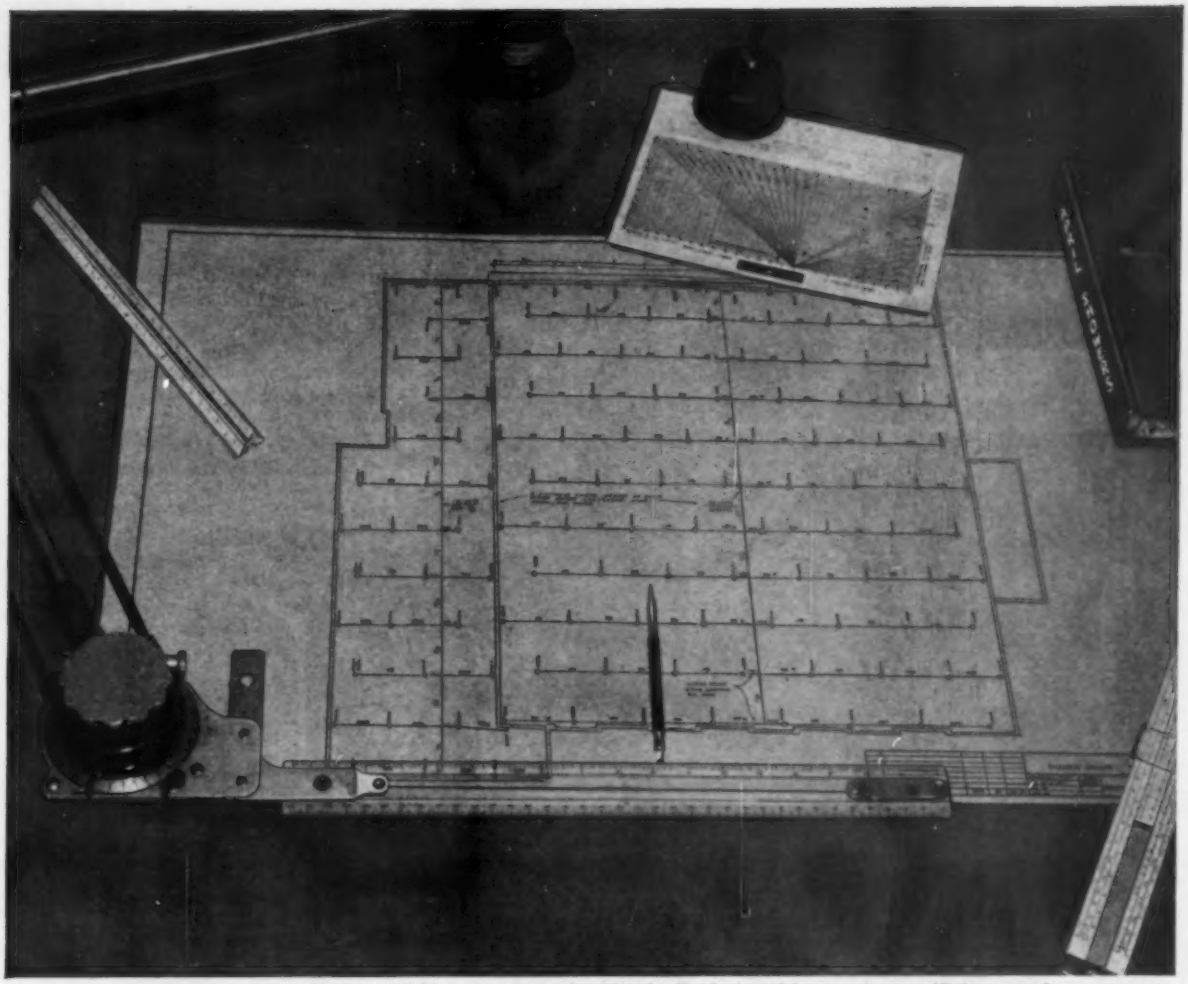
▲ For details, circle 53 on Post Card

DUAL VALVE ASSEMBLY has safety interlock feature

An addition to company's trip control line of two-hand "can't cheat" systems, this dual valve assembly with electrically interlocked protection can also be used separately on all machines



having air-actuated clutches. If one valve remains open when de-energized the other valve is designed to close and stop the machine. Before another stroke or cycle can be started, the



Each April Showers system is individually designed for maximum efficiency and economy.

KEEP COOLER...CUT AIR CONDITIONING COSTS with **APRIL SHOWERS** ROOF COOLING SYSTEMS

Effective – April Showers uses evaporative roof cooling to drop roof temperatures as much as 50 degrees, and lower inside temperatures 10 to 15 degrees. It can be used with air conditioning, or alone on buildings that are difficult to air condition.

Patented, scientifically-designed spray heads produce droplets of water that wet the entire roof. Automatic controls assure maximum cooling . . . minimum water consumption.

Economical – An April Showers system can reduce the amount of air conditioning equipment needed by 15 to 25% . . . operating costs drop proportionately.

Yet the cost of an April Showers system – installed on your roof – is amazingly low.

April Showers representatives and installation facilities throughout the country assure fast, reliable service.

Send for free literature fully explaining these and other benefits you will get with April Showers.

April Showers Company

Division of

SWARTWOUT Fabricators, Inc.

Kokomo, Indiana

For more facts circle 624 on Reply Card

SELF-PROPELLED K-4 removes traffic-packed dirt in 1 operation. Operator merely guides it.

removes 2 tons of incrusted grime in less than 8 hours

New self-propelling TENNANT Model K-4 Floor Machine shears off and picks up hard-packed layers of grease-caked dirt *in one operation.* Lets one man do a faster, cleaner job than a 6-man crew with hand scrapers!

Machine does all the work—you simply guide it. Propels itself forward . . . reverses instantly at touch of a lever. Propels itself back over pulverized path for extra-clean "whisk-broom" type pick-up. *Easier than ever to use.*

Has many new features—30% larger envelope-type, vacuumized filter (over hopper) for better dust control . . . new longer-wearing wire brush . . . 28% more powerful engine—plus many other cost-saving features.

Terrific cleaning power—Can remove over 2 tons of traffic-packed dirt per shift . . . shears off tough build-up other methods can't touch. 1725 rpm tool cleans a 16" path lightning fast. No hand-scraping, no chemicals, soap or water. Leaves floor clean, dry and hump-free, ready for immediate, faster traffic. *Before-and-after photos below are graphic proof of dramatic results.*

BEFORE—Heavy grease-caked grime on wood block floor in busy aisle "drags" at truck wheels . . . slows traffic to a crawl.

AFTER—High-speed K-4 instantly pulverizes and picks up tough, heavy dirt . . . cleans right down to floor surface.

WRITE TODAY *for illustrated bulletin, photos and performance data.* G. H. Tennant Co., 771 E. No. Lilac Drive, Minneapolis 22, Minnesota.

TENNANT

HEAVY-DUTY
FLOOR
MACHINES

SPECIALIZED MAINTENANCE EQUIPMENT

POWER SWEEPERS • FLOOR MACHINES • SCARIFIERS • ROOF SCRAPERS • CONCRETE ROUTERS

For more facts circle 625 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

defective valve must be repaired or replaced. Assembly includes two 3-way valves, connected in series, two limit switches, and a wiring enclosure. Available with ⅜ and ¾ in. valves, in 115, 230 or 460-v, 60 cycle a-c, in two-price ranges under $230. Micro Switch, Div., Minneapolis-Honeywell Regulator Co.

For details, circle 54 on Post Card

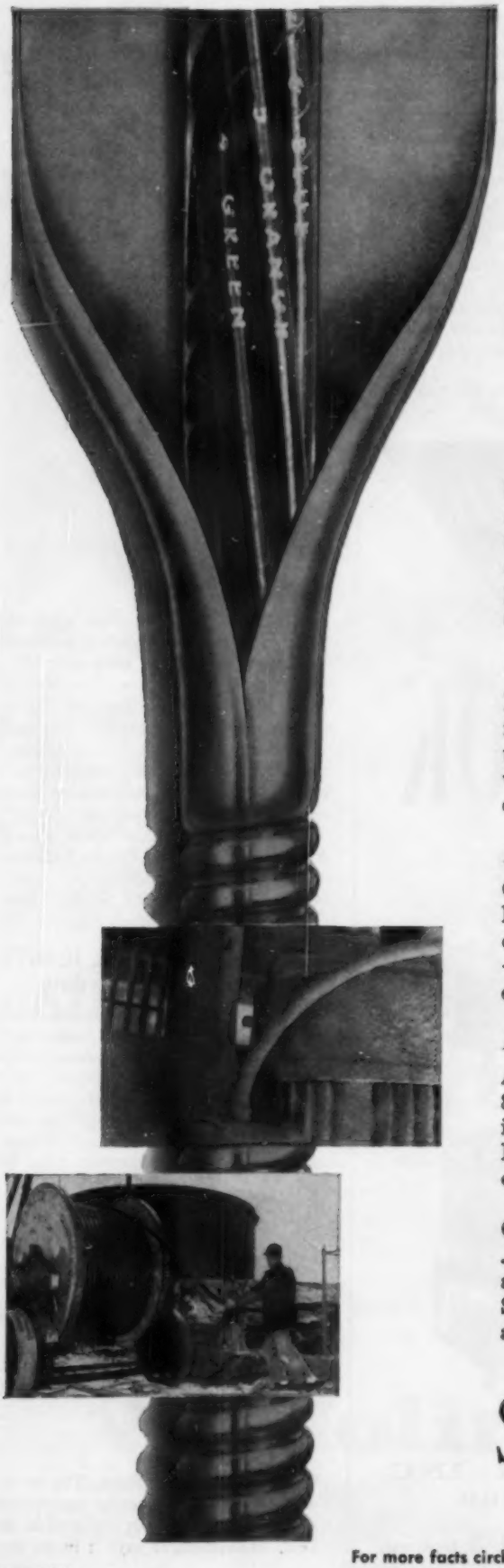
Reader Service Post Cards for requesting more details on products described are provided on pages 217-218.

COMPACT INSTRUMENT speeds cable tracing

The Amprobe Cable Tracer is reported capable of helping any electrician trace and identify conductors in cables, by himself, in less time and with less effort than by other methods. It is designed to trace up to 10 conductors or pairs at one time, without need for

buzzers, bells or a helper. The unit consists of the tester and 10 numbered station blocks. In operation, the ends of the conductors to be traced are plugged into the station blocks and the other ends plugged into the tester itself. Numbers on the tester, corresponding to those of the station blocks, light up to identify conductors.

Self-powered and compact (less than 6 in. long), the instrument also offers a means of testing for opens and shorts. It accepts any size wire up to No. 8 (larger sizes using the alligator-clip adapters provided). Station blocks may be used individually or combined on the racks for common-ground applica-



Only C-L-X®

Continuous Lightweight eXterior

Sealed Cable Systems by Simplex Can do so Many Jobs so Well

Simplex C-L-X is a packaged combination of cable and an extremely pliable, corrugated metal sheath. It requires no separate duct or conduit regardless of environment. It is available with steel sheath and plastic jacketing; and with copper or aluminum sheaths, with or without plastic jacketing.

C-L-X Cuts Installation Costs

By using a single length of 3-conductor 15KV C-L-X for both underground and aerial use, a Southeastern utility company saved more than 20,000 dollars from what it would have cost for a complete underground duct system.

Resists Chemical Attack

Conduit life in this company's calcium chloride reclamation building was only 6 to 9 months. The conduit was replaced with a C-L-X cable system which — after two years of operation, shows no signs of deterioration.

Protects Against Liquids and Gases

An East Coast petroleum tank farm used a C-L-X 8-conductor cable protected with PVC for direct burial in ground that was saturated with oil, gas and water. Result: Perfect performance at a sizeable savings over conduit systems.

Only Simplex C-L-X offers you: Exceptional Strength . . . Unequalled Pliability . . . Protection from Liquids and Gases . . . Faster Installation and Lower Costs. Send for Illustrated Brochure containing Application and Engineering Data.

SIMPLEX WIRE & CABLE Co

CAMBRIDGE, MASSACHUSETTS

For more facts circle 626 on Reply Card

PLANT ENGINEERING EQUIPMENT

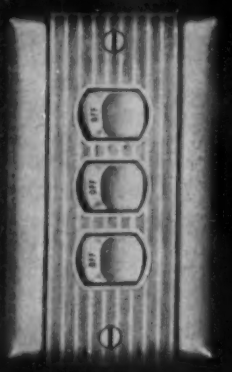
(Begins on page 168)

tion. Furnished in a leather carrying case with three test leads the unit costs around $40. Pyramid Instrument Corp.
For details, circle 55 on Post Card

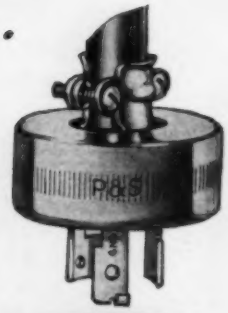
DUST LEVEL ALARM uses no moving parts in hopper

This device consists of a differential pressure switch unit and two sensing cones for installation at different levels in the hopper. Whenever fly-ash or other finely divided dry material reaches a pre-determined level (indicated by lower cone) a pressure differential triggers the switch, which in turn electrically actuates an external alarm. Actuating unit, installed outside the hopper, contains the only moving parts: a Micro-Switch and a differential pressure diaphragm. It also accommodates pressure sensing line for each side of diaphragm, one line extending to high pressure end bell and the other to the low. Aerotec Industries, Inc.
For details, circle 56 on Post Card

P&S means ROCKER-GLO and TURNLOK too....



P&S PERFORMANCE SPECIFIED



The same engineering know-how that goes into the manufacture of world-famous *Rocker-Glo* switches, makes *Turnlok* wiring devices supreme in their field, too. On heavy duty devices or residential, the *P&S* mark is your guarantee of the best your money can buy.

For free information about *Turnlok* and *Rocker-Glo*
Write Dept. PE-561

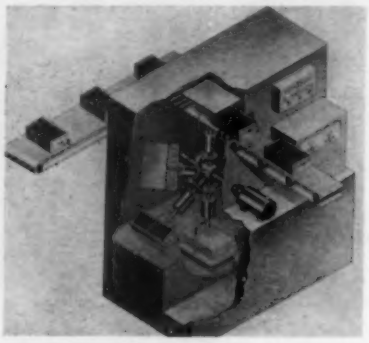
P&S PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK

60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill. In Canada: Renfrew Electric Co., Ltd., Toronto, Ontario

For more facts circle 627 on Reply Card

ULTRASONIC CLEANER cleans tote boxes and loads

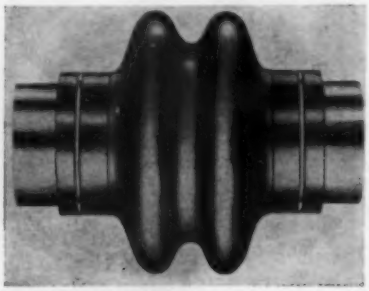
Designed to load, ultrasonically clean and degrease, dry, and unload tote-box loads of metal parts, the AutoSonex V-72 Loaded Tote Box Cleaner is fully automated and requires no operator. It is reported particularly efficient for delicate assemblies and parts that can't take impingement or tumbling. The



process immerses individual loads of parts in a greasing solution powered by ultrasonics, rinses with pure distillate spray and vapor, drains and passes them through a free-board drying stage before discharging. The box is cleaned at the same time as its contents, states manufacturer, and the machine's operating and maintenance costs are less than for conventional methods. About 6-by-10 ft of floor space is used for most applications. Drying facilities can be added. Autosonics Inc.
For details, circle 57 on Post Card

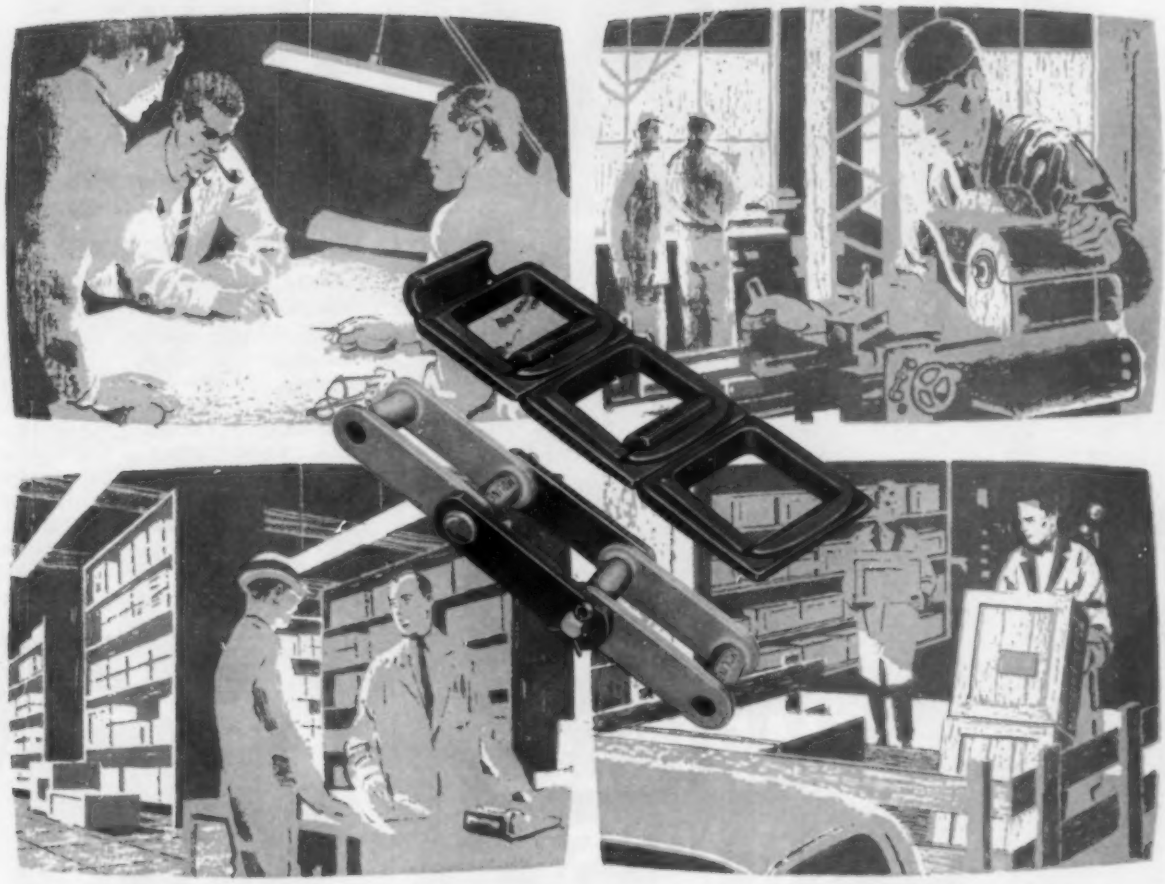
BOOTED UNIVERSAL JOINTS for severe service duty

These booted universal joints have been developed for: heavy loads, high speeds and/or high heat; contact with dust and other contamination; and situations where lubrication with oil is difficult or impossible. Of stainless steel alloy, they have oil-resistant Neoprene covers which permit them to

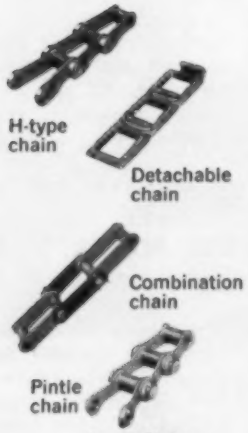


be pre-packed with grease. The cover, or boot, is held in place by snap wires, and can be removed or replaced in the field. Manufacturer says it in no way

You get MORE when you...



call your Moline Chain Distributor



Specializing in the manufacture of chains

GET THE "EXTRA SERVICES" and save your precious time by calling your local Moline Chain distributor when you need chain for conveying, elevating and power transmission.

Your Moline Chain distributor offers much more than just a source of supply. His is a "local service business"—and he has the engineering experience and know-how to help solve your problems. He has also a crew of technical men—machinists, gear cutters, installation and maintenance men—to give you special service. And he carries a tremendous stock—as many as 7000 items—virtually any item needed for efficient power transmission.

You can depend upon *fast service* too, so call your Moline Chain distributor today!

Moline Chains

Leaders for 60 years

for conveying, elevating and power transmission

MOLINE MALLEABLE IRON CO., St. Charles, Illinois

For more facts circle 628 on Reply Card

The way to whip fan noise problems without sacrificing on air moving efficiency is to insist on HARTZELL LO-NOISE FANS!

Special air-foil blade which is designed to operate efficiently at slow speeds reduces noise intensity by as much as 30% below that of conventional propeller fans. Exclusive Hartzell curved orifice air seal ring further increases efficiency and reduces noise by eliminating turbulence and backflow of air at the propeller tips. Seven sizes, 24" to 60". Cast aluminum alloy propellers, ring or panel mounting.

Hartzell PROPELLER FAN COMPANY
Division of Castle Hills Corp. • PIQUA, OHIO
(HARTZELL)

For more facts circle 629 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

affects performance of the joint, allowing operation through a 40-deg working angle. Standard and heavy-duty types are available. Lovejoy Flexible Coupling Co.

▲ For details, circle 58 on Post Card

MOLDED CASE BREAKER, 100 amp, requires less space

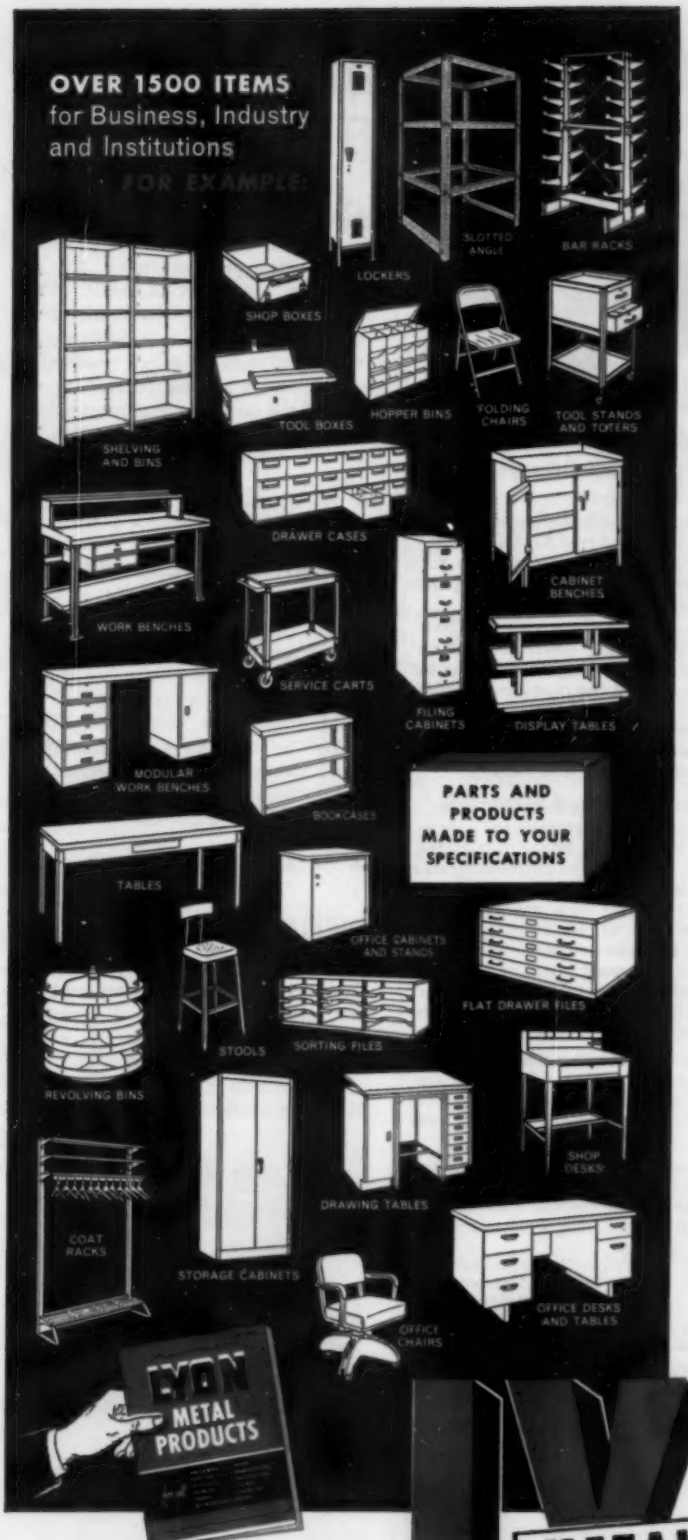
Substantial cost- and space-savings are provided by these 100-amp two- and three-pole molded case circuit breakers, announced as the smallest available for use as main breakers. Designated EQ-P (for plug-in connection) and EQ-B (for bolt-in connection), the breakers can replace larger E-frame units formerly used when 100-amp ratings were required. Only 2⅞ in. high and 2 in. (two poles) or 3 in. (three poles) wide, these breakers reduce mounting space

requirements by as much as two-thirds. A three-pole EQ-P (shown at right) requires only 8⅝ sq. in. as compared to 27 sq. in. for the E-frame unit. Expanded handles running the width of the breaker, give extra gripping area for easier manual operation; they also, span and thus show the poles operated by each breaker handle in a panelboard. I-T-E Circuit Breaker Co.

▲ For details, circle 59 on Post Card

MINIATURE POWER TOOL does full-size job

The Series GG, a bench-type flexible shaft machine incorporates a new carbon-pile, continuously variable foot rheostat. It features a 1/10-hp universal motor with two speed ranges. A gear box gives high torque at low speeds. High speeds to 12,000 rpm can be obtained on direct drive. Easily portable, the unit weighs less than 9 lb,



THIS CATALOG ILLUSTRATES
THE WORLD'S MOST
DIVERSIFIED LINE
OF STEEL EQUIPMENT
IT'S FREE!

5 TO 1 in '55

AND NOW IT'S 7 TO 1

In a preference survey made by an independent organization back in 1955, key men in companies throughout the country gave Lyon 5 times more first choice votes than any other steel equipment manufacturer.

In a comparable survey made in 1960, Lyon's first choice margin jumped to 7 to 1! And Lyon received more exclusive mentions than the next 22 companies combined!

Your nearest Lyon Dealer offers the world's most diversified and *most preferred* line of steel equipment—quality protected to give you the most for your investment.

LYON METAL PRODUCTS, INC.

General Offices: 591 Monroe Ave., Aurora, Illinois
Factories in Aurora, Ill.—York, Pa.—Los Angeles
Dealers and Branches in All Principal Cities

LYON® METAL PRODUCTS

For more facts circle 630 on Reply Card

DO YOU KNOW WHAT METALLIZING CAN DO FOR YOU TODAY?

With today's improved metallizing materials and methods:

***Plant executives* find new ways to slash maintenance costs, reduce downtime, cut machine parts inventory...**

These real-life examples show how plants save money with metallizing:

Necks of winding rolls in a textile mill were formerly repaired by a slow machining method, requiring highly skilled labor. Now the worn necks are built up with flame sprayed metal, quickly machined to size. Savings run $20,000 a year.

Valve plugs and seats, working in sand, oil and salt water, lasted only a few hours in service. Hard-faced by welding, a set cost $155, lasted from 3 to 8 hours. When flame sprayed with tungsten carbide powder, service life was increased to a minimum of *2 weeks,* 4100% longer! Cost of metallized set, $73. But reduced downtime far outweighs the dollar savings.

A Connecticut company was sending its worn shafts out for repair by welding at a cost of $50 each. Then they found a local shop that specialized in metallizing was able to do a better job for $27.50. The same job shop salvaged a big degreasing tank, value $2,850, by flame spraying with zinc for $683. The shop made money, the customer saved money.

A shipbuilding company installed metallizing equipment to repair such parts as pump rods, pistons, crank shafts for diesel engines, stern bushings, valve stems. A badly worn tugboat shaft, replacement cost $3,000, was repaired and made better than new for $400. That job alone more than paid for the METCO equipment.

From these cases you can see how modern metallizing pays, whether in plant maintenance departments or in job shops serving the many companies that don't need their own installation. Wherever there's wear, in rotary or sliding action, there's an opportunity to save money and make money.

New and improved materials

Among these new materials are a number of nickel, chrome, boron hard facing powders. Sprayed tungsten carbides are also widely used. Many others are available to give new values to the basic benefits of metallizing, which may be summarized as: less downtime; far less machining or grinding time, reduced parts inventory; and "better than new" performance of the metallized parts.

With savings like these there are big opportunities for more efficient maintenance operations, either with METCO installations or through local job shops.

To explore these advantages and see how they apply to your operation, check the coupon below and send it off today.

METCO INC.
FORMERLY METALLIZING ENGINEERING CO., INC.
Flame Spray Equipment and Supplies

1195 Prospect Avenue, Westbury, L. I.
New York Telephone: Edgewood 4-1300
Cable: METCO. In Great Britain: METCO, Ltd., Chobham-near-Woking, England

METCO INC., 1195 Prospect Avenue, Westbury, L. I., New York

How to SAVE MONEY and cut downtime with Metallizing

☐ Send copy of Bulletin 15, "How to Save Money and Cut Downtime with Metallizing"
☐ Have Field Engineer Call

Name _____
Title _____
Company _____
Address _____
City _____ Zone _____ State _____

For more facts circle 631 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 168)

plugs into a 110-v a-c or d-c outlet. A selection of pencil-slim and miniature angle-type handpieces for use with tool are interchangeable. They accept rotary tools with shanks from 1/32 to 1/4 in. Uses on materials ranging from metal to glass include production, toolroom or maintenance applications. Cost of the complete unit ranges from around $74 to $87 depending on the type of handpiece selected. Foredom Electric Co., Inc.

▲ **For details, circle 60 on Post Card**

MARKING TUBE has different size ball points

This writing tube has different size ball points for making lines 5/64, 1/8 or 3/16 in. wide. It contains a fast drying, opaque ink that withstands heat and weathering under adverse conditions. It can be used to code, number or mark smooth or rough surfaces of metal, wood, plastic and glass, and is available in eight colors. John P. Nissen, Jr. Co.

▲ **For details, circle 61 on Post Card**

DIPPING CONTAINER with a handy strainer basket

Jaldip consists of an all-steel container and dip-strainer basket designed for cleaning or applying protective coatings to tools, machine parts and other shop products and accessories. Container is available in 1½- and 6-gal

sizes, with removable lug cover or lever ring closure. Strainer basket has hooks for attaching to container during drainage and legs to keep it clear of sediment on container bottom. Jones & Laughlin Steel Corp.

▲ **For details, circle 62 on Post Card**

Here are tips to help you achieve packing-fluid compatibility!

The efficiency, safety and ultimate cost of a hydraulic system is largely dependent on the compatibility of its packings and fluid medium . . . how well they do or do not work together.

Mineral Oils

The above is frequently overlooked when a plant switches from one type of fluid to another. Take *mineral oils*, for example. Three general types are used in hydraulics, and are classified according to their aniline points: high, medium and low.

If, through error, a high aniline oil is used where low aniline oils are specified, rubber seals in the system would shrink and harden. Conversely, "high aniline" rubber seals will swell and soften in low aniline hydraulic oils. Leakage or equipment failure is the result.

To complicate the picture further, mineral oils made to the same specification by different oil manufacturers, using different crudes, will vary in aniline point to the degree that they may cause synthetic rubber seals to either shrink or swell.

Even among the various types of synthetic rubber used for hydraulic seals, the reactions to mineral oils vary. Buna S and Butyl seals, for example, will disintegrate in mineral oil while Buna N, Neoprene, Viton and Thiokol polymers work very well.

Fire-Resistant Fluids

In many hydraulic systems, *mineral oils* are being replaced by modern, synthetic fluids which eliminate fire hazards without affecting hydraulic efficiency.

Three types of fire-resistant fluids are in wide usage and each type requires a *compatible* packing.

The three basic types of synthetic fluids with *recommended* and *maximum recommended* operating temperatures are shown in the box.

Type	Recommended Temperature	Maximum Recommended Temperature
Phosphate Ester	+130°F.	+180°F.
Water-Glycol	120°	150°
Emulsion water-oil	120°	150°

Phosphate Ester fluids and mineral oils have a directly opposite effect on the same rubber seals. Butyl packings which fail miserably in mineral oils, work beautifully with straight Phosphate Ester while Buna N, which works well in mineral oils, is unsuitable for Phosphate Ester. For this reason, changing a system from mineral oil to Phosphate Ester requires a complete and careful flushing and cleaning *as well as a switch in packing materials*, if elastomer packings are used.

For use with these fluids, homogeneous packings should be of Butyl, fabricated packings of Butyl and duck or asbestos and leather packings should be either Wax or Thiokol impregnated.

Water-Glycol fluids are generally compatible with both Buna N and Butyl seals, and with duck or asbestos. However, they do attack leather fibers. Water-Glycols have a pH of 8.5 to 10.5 and leather fibers start to disintegrate at a pH over 8.0

Because of this pH condition, leather packings are not recommended for use with Water-Glycols. Homogeneous packings should be of Buna N and fabricated packings of either asbestos or duck and Buna N.

Emulsion type fluids react much the same as mineral oils do with rubber and leather. In homogeneous and fabricated packings, use Buna N; in leather, use a filler of wax or Thiokol. Never use Emulsion fluids with Butyl.

A Simple Solution

As complex as the subject appears, packing-fluid compatibility in hydraulic systems can be determined with very little trouble. Houghton Packing-Fluid Compatibility Tables will instantly tell you which packings work best with the various types of fluids in general use.

Better yet, Houghton is in a unique position to give you completely unbiased answers to your hydraulic packing-fluid problems, for **Houghton is the only manufacturer who offers you a complete line of both packings and fluids for industrial hydraulic systems.**

FREE! Packing-Fluid Compatibility Tables

For your copy of Houghton's Packing-Fluid Compatibility Table, or for help on any hydraulic packing or fluid problem, call your Houghton representative or write: E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

Houghton

INDUSTRY'S PARTNER IN PRODUCTION

For more facts circle 632 on Reply Card

Industrial Plant Construction

(Continued from page 148)

high and about 32 ft in diameter. A satellite, placed inside the chamber, could be subjected to extreme range of temperatures that are encountered in flight. Test center will have a temperature humidity chamber and a complex vibrating system that can rock satellite vehicles with a force of 14 tons.

Carlsbad, N. M.—Potash Company of America has awarded a contract to Stearns-Rogers Manufacturing Co., Denver, Colo., for engineering and construction work on the modernization of company's potash plant at this location. Work on the project will begin soon at a cost estimated to be about $3.5 million. Modernization program will be completed in 1962.

Ravena, N. Y.—Cerro Corporation, and Newmont Mining Company, have announced plans for a joint venture and will construct a $64-million cement plant and mill on a 2000-acre site on the Hudson River at this location. New mill will have a capacity of 10 million bbl of cement annually and will include two of the largest kilns ever constructed in this country. A company to be known as the Atlantic Cement Company, Inc., will be formed to operate the facility. Construction of the new facility will start shortly with production slated to start in the spring of 1963.

Jal, N. M.—El Paso Natural Gas Co., El Paso, Texas, will start work in July on the construction of an ethane recovery unit near here to supply raw materials for company's refining-petrochemical operations at Odessa, Texas. Plant will be designed to have a capacity to process 650 million cu ft of natural gas daily and recover 3600 bbl of ethane, 7000 bbl of propane and 1320 bbl of butane daily.

North Canton, O.—Hoover Company, Die Castings Division, 101 Maple St., plans to construct a $2 million addition to company's manufacturing facilities at this location. New facility, which will contain 47,500 sq ft of production space, is slated for completion early next year.

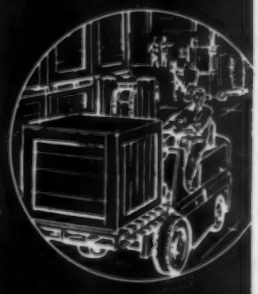
Wilkes-Barre, Pa.—Pall Corp., Glen Cove, N. Y., plans to construct an integrated glass-making and fiber-drawing plant on large site here. Plant will have a capacity of about 10 million lb of the product annually and will cost in the neighborhood of $1.8 million when completed. Work on the new facility will get under way shortly and is scheduled to be completed in the early part of 1962. Plant will be operated by company's wholly owned subsidiary, Fibrous Glass Products, Inc.

Willow Grove, Pa.—Elco Corporation, M Street and Erie Ave., Philadelphia, Pa., plans to construct a plant and administration facilities on large site located here. Contract in the amount of $1 million was awarded to George K. Heebner, Inc., 1231 Vine St., Philadelphia, Pa., for the work which will begin at once. Plant is scheduled to go into production by the second quarter of 1962. Everett Associates, Commonwealth Building, Allentown, Pa., is the architect.

Greenwood, S. C.—Parke, Davis & Co., Detroit, Mich., plans to construct a surgical dressings manufacturing plant on large site here. Four one-story buildings with a total of 188,300 sq ft will be erected on the site. New facility will be completed by early 1962 at a cost estimated at $4 million.

Houston, Texas—Bemis Brothers Bag Company, 408 Pine St., St. Louis, Mo., plans to erect a facility here for the production of paper, textile and open mesh bags. New plant will have a floor area of 200,000 sq ft and will cost approximately $1.5 million, not including machinery and other contents. Ground will be broken soon with completion scheduled for late fall and full operation some time in 1962.

100 TO 1
YOU'LL BE
WITHOUT LIGHTS
SOMETIME
THIS YEAR!



When that happens, will you depend on flashlights? Not if Light Warden is on the job to prevent panic, theft, injury and property damage for you.

When electricity goes off, Light Warden goes on—gives you light instantly where you need it—at exits, corridors, stairwells and other danger spots. Light Warden is fully automatic and is guaranteed for up to 15 years.

What are the odds you need Light Warden? Our booklet "The Odds On Emergency Lighting" will tell you when you need Light Warden, how Light Warden works, and how much Light Warden costs. Your copy will be return-mailed at your request.

LIGHT WARDEN Chargomatic emergency lighting equipment

ELECTRIC CORD COMPANY
432 Plane Street, Newark 2, New Jersey

For more facts circle 633 on Reply Card

Section of cracked water-jacket casing repaired with an epoxy-based compound that cures without heat or pressure. Compound is manufactured by the Devcon Corporation, Danvers, Mass. and Devcon, Ltd., Canada.

EPOXY-BASED COMPOUND USED IN REPAIR OF COMPRESSOR

results in savings of more than $1200

When an ammonia compressor at a large brewery developed extensive fractures around the cylinder casing, it was repaired quickly with an epoxy-powdered steel compound called "Plastic Steel." The compressor *continued in operation* during the repair. It was estimated that savings in labor, materials and down time were in excess of $1200.00.

Compound based on BAKELITE liquid epoxy resins, such as the one used for this repair, can be brushed, sprayed or troweled and are ideal for a wide variety of industrial maintenance applications.

For more information on how you can solve maintenance problems with epoxies, contact your nearest supplier of BAKELITE epoxy compounds, or write Dept. HL-100E, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 12.

UNION CARBIDE

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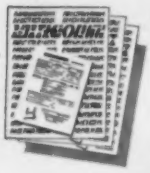
For more facts circle 634 on Reply Card

IF YOU SPEND OVER

$1,000



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For more facts circle 635 on Reply Card

NEW BOOKS

for the plant engineer

Income of Engineers

PROFESSIONAL INCOME OF ENGINEERS—1960. Size about 11 by 9½ in.; over 40 pp; paper bound. Available from Engineering Manpower Commission (EJC) 29 West 39th St., New York 18, N.Y. Price $3.00 plus handling charge.

INCOME FIGURES of many thousands of engineers were accumulated in a sampling representing the fourth in the series of studies on salaries of engineers. The book brings out what was included in the interpretation of salary. This report carries charts and tables developed from the gathered data.

Various curves in the report show the relationship of salaries to the baccalaureate years. Some returns reportedly were received giving age bases. A number of these figures, representing a small percentage, were incorporated with the information based on year degree was awarded. This was done after careful study. In one area there was enough difference that separate curves were plotted using age and baccalaureate data.

This publication includes salary curves pertaining to the following fields: aircraft parts, chemical, construction, consulting services, petroleum, machinery manufacturing, instrument manufacturing, and some others. It also contains curves representing a grouping of industries and graduates, besides other material.

Boilers—Types, Characteristics

BOILERS: TYPES, CHARACTERISTICS, AND FUNCTIONS by Carl D. Shields. Size 10¼ by 7¼ in.; 550 pp including index; illustrated; paper bound. Published by F. W. Dodge Corporation, 119 West 40th Street, New York 18, N. Y. Price $15.00

THIS BOOK has much to offer in the way of information on boilers. Many facets have been considered in the preparation of this book which incorporates the practical approach. Material in this work pertains to many types of boilers and takes in the treatment of units for various areas of usage.

The main text is divided into seven principal sections, namely boiler classification, boiler design, steam generating equipment, boiler construction, industry regulation, and industry status.

Among the many subjects on which information appears in this liberally illustrated publication are the following: steel fire-tube boiler, cast-iron boilers, boiler furnace and fireside design, boiler blowdown and steam purification, economizers and air heaters, packaged boilers, central station steam generators, nuclear power, steel boiler manufacture, firing equipment, boiler auxiliaries, codes and standards, boiler inspection, boiler performance, and industry trends.

Transistors

TRANSISTOR MANUAL. Size 8½ by 6 in. approx; over 325 pp; illustrated; paper cover with plastic spiral back. Available from franchised General Electric Co. distributors. Price $1.00.

THIS MANUAL on semiconductors is in the fifth edition. It sheds light on the nature and behavior of transistors and the application of semiconductor devices. Many circuit diagrams appear in the book.

Beginning with a section on basic theory, the manual includes chapters on small and large signal characteristics, biasing, audio amplifiers, switching characteristics, tunnel diode amplifiers, feedback and servo amplifiers, power supplies, test circuits and other topics.

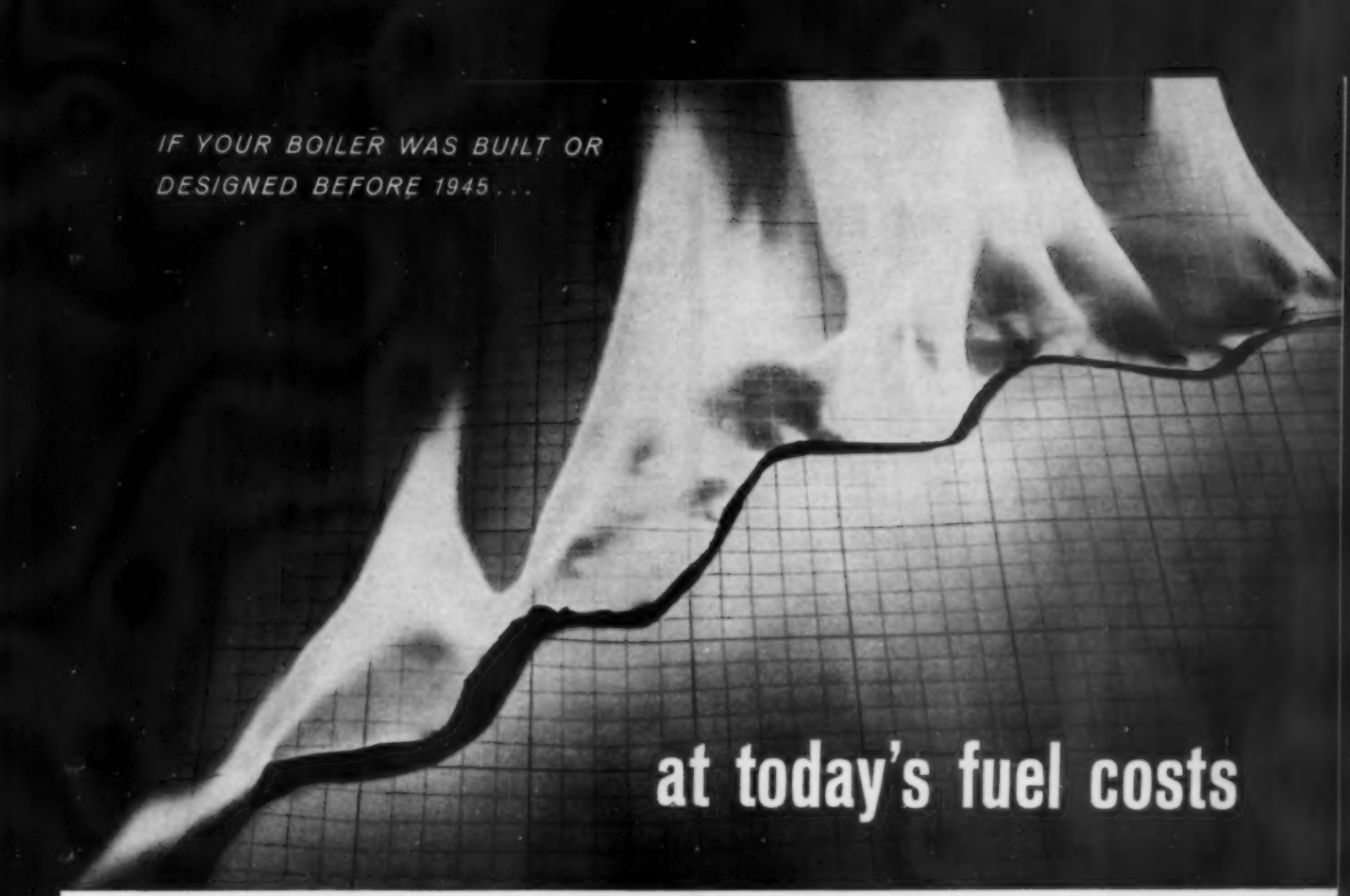
The book includes tabled information on specifications and on registered JEDEC transistor types, taking in maximum ratings and electrical parameters. For further reading, a reference list of publications appears at the back of the book.

Water Pollution

THE NATIONAL CONFERENCE ON WATER POLLUTION PROCEEDINGS. Size 9⅛ by 5⅞ in.; over 600 pp including appendices; paper bound. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price $2.25.

IN DECEMBER of 1960 an important conference was held on a problem of wide concern. In this publication are presented comments and discussions from the various sessions of the two-day proceedings relating to water pollution.

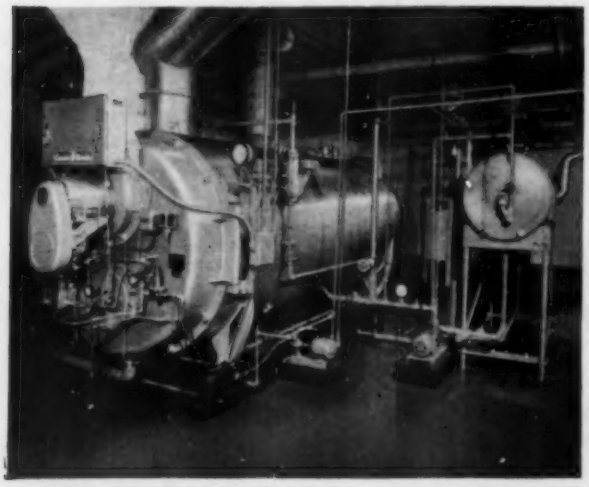
Some of the topics treated at this conference and on which information appears in this book are as follows: impacts of pollution on health; impacts of water pollution on industry; priorities for water use; effects of land use and treatment on pollution; the needs and obligations of industry; legal aspects of water pollution control; critical research needs—environmental aspects; and public awareness and citizen responsibility.



you may be paying for it a second time!

GETTING MORE HEAT FOR THE FUEL DOLLAR

The W. T. Rawleigh Company, manufacturer of toiletries, medicines and food products for the home and farm, replaced two old firebox boilers in their Memphis, Tennessee, branch with one fully automatic, combination-fired CB boiler. Mr. James Trindle, office manager, reports: "Our records show... 36.4% less fuel consumed during winter months that averaged about 12% colder than the previous year. We're getting greater fuel economy than we expected."



Are you operating a boiler that was designed in the day when fuel costs were much lower? Just since World War II, fuel prices have soared. And these higher costs put a premium on "little" inefficiencies that might have been ignored when your boiler was built.

Conversion is not the answer. You cannot buy efficiency in a boiler designed for solid fuels simply by switching to a conversion-type oil or gas burner. The answer is a *truly* packaged Cleaver-Brooks boiler — with all components designed to work together — fully factory-assembled and fire-tested.

To further provide and maintain top efficiency, modern Cleaver-Brooks packaged boilers offer a combination of fuel-saving design standards that cannot be found in any other boiler — at any price.

This combination of features — *four-pass design, forced-draft combustion, updraft construction and all the advantages of five square feet of heat-transfer surface per boiler horsepower* — puts your fuel costs down where they belong.

All this is provided by Cleaver-Brooks in the most compact, automatic packaged unit on the market. Sizes through 600 hp... oil, gas and combination oil-gas firing... larger sizes in Cleaver-Brooks Springfield water-tube boilers. *All* models are expertly started for you by a trained field engineer.

See your local Cleaver-Brooks agent for more detailed information, or write for the booklet, *How to Select a Boiler.*

Cleaver Brooks®

ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

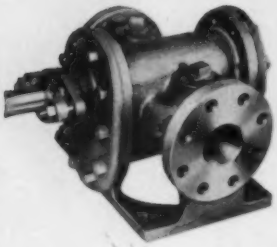
CLEAVER-BROOKS COMPANY

Dept. F, 364 E. Keefe Ave., Milwaukee 12, Wisconsin

For more facts circle 636 on Reply Card

SK Gear Pumps

HANDLE MANY MATERIALS



Engineers in all types of plants are using SK Gear Pumps to handle materials ranging from kerosene to glue. Time after time these pumps have replaced other types in critical applications. In case after case they have solved costly maintenance or poor performance problems. And, what they have done for others they can also do for you. Why not tell us about your application. We'll be glad to help.

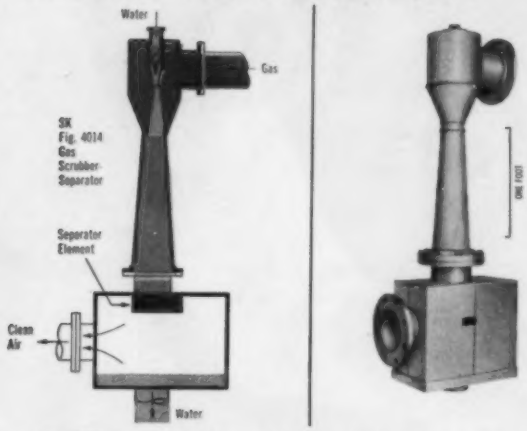
For details—ask for Bulletin G-1

Or Circle 637 on Reply Card

SK Introduces New

GAS SCRUBBER-SEPARATOR

New "packaged" unit offers never-before-obtainable efficiency. Combines SK ejector-venturi scrubber with new separator which reduces liquid carryover to 0.00002 gal. per 100 cfm. Unit, called "Fig. 4014" is low cost, compact. Stocked in popular sizes for immediate shipment.



For details—ask for Bulletin Supplement 4R.

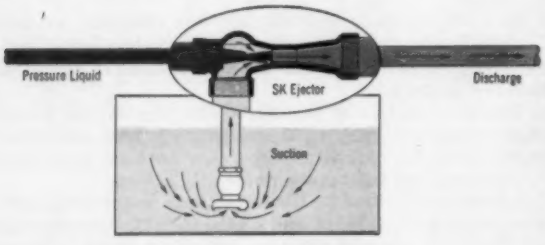
Or Circle 638 on Reply Card

SK Liquid Jet Ejectors

PUMP AND MIX SIMULTANEOUSLY

SK Liquid Jet Ejectors utilize the kinetic energy of a liquid under pressure to entrain, mix, and pump liquids or handle slurries and granular solids. Uses vary from pumping out a sump to mixing chemicals in proper proportions.

Some user benefits: (1) *economy*—a 2-inch, bronze unit costs only $51.00; (2) *maintenance-free service*—simple construction and lack of moving parts makes supervision unnecessary; (3) *availability*—stocked in popular sizes in Pennsylvania, Texas, California; (4) *adaptability*—made and stocked in cast iron, bronze, stainless steel, asbestos-filled resin, PYREX brand tubing, and PVC.

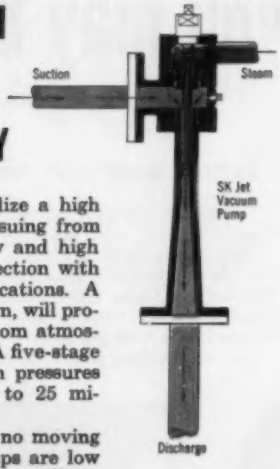


For details—ask for Bulletin 2M

Or Circle 639 on Reply Card

SK Steam Jet Vacuum Pumps

PRODUCE HIGH VACUUM ECONOMICALLY



SK Vacuum Pumps utilize a high velocity jet of steam, issuing from a nozzle, to provide low and high vacuum service in connection with numerous process applications. A single-stage unit, as shown, will provide suction pressures from atmosphere to 1.5 in. Hg abs. A five-stage unit will provide suction pressures from 0.25 mm Hg abs to 25 microns Hg abs.

Simple in design, with no moving parts, SK Vacuum Pumps are low in cost, economical to operate. They are available in popular sizes in various materials from stock in Pennsylvania, Texas, California.

For details—ask for Bulletin 5E

Or Circle 640 on Reply Card

JET APPARATUS: Ask for Condensed Bulletin J-1.

ROTAMETERS & FLOW INDICATORS: Ask for Condensed Bulletin M-1.

VALVES: Ask for Condensed Bulletin V-1.

HEAT TRANSFER APPARATUS: Ask for Condensed Bulletin HT-1.

GEAR PUMPS: Ask for Bulletin G-1.

Schutte and Koerting

COMPANY

MANUFACTURING ENGINEERS SINCE 1876

2279 State Road, Cornwells Heights, Bucks County, Pa.

Phone: MErcury 9-0900 TWX: Cornwells, Pa. 69-U

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MAY, 1961

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Plant Engineering

Please have manufacturers send without obligation information or bulletins indicated by numbers circled.

Your Name..... Your Title.....

Your Company Name.....

Company Address..... City..... State.....

Please CIRCLE ITEM NUMBER DESIRED

PRODUCTS

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
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MAY, 1961

This card good only until August 31, 1961

Plant Engineering

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BULLETINS

(Begins on page 21)

Floor Resurfacer—Details on Poly-Gard floor resurfacer—a chemical, abrasion and impact resistant compound for use in overlaying and patching all types of floors—are presented in this product bulletin. Technical data and application method covered. Guardian Industrial Products, Inc.
▲ For a copy, circle 143 on Post Card

Industrial Floor Machine—Bulletin 81.5 D-R describes an industrial floor machine designed to remove grease-caked dirt from floors in one operation. Photos of typical uses are included along with mechanical data. G. H. Tennant Co.
▲ For a copy, circle 144 on Post Card

TOOLS, WELDING AND MACHINE SHOP

Construction Tools—A wide selection of hand tools and equipment for builders is provided in this 64-pp 1961 catalog. Pictures and describes over 1000 machines and hand tools, including mechanical drywall texturing equipment, as well as a piston pump plastering machine. New concrete finishing tools, a low cost story pole system, portable masonry saw are presented. Goldblatt Tool Co.
▲ For a copy, circle 145 on Post Card

100 Power Tools—Comprehensive information on a variety of power tools and accessories for construction, maintenance and other applications is presented in this 68-pp 1961 catalog. Specifications and selection tables are included for such diverse tools as worm-drive power saws, metal-cutting power hacksaws, all-purpose reciprocating saws, jig saws, drills, finishing sanders and routers. Skil Corp.
▲ For a copy, circle 146 on Post Card

Portable Power Tools—High frequency electric tools, including grinders, sanders, polishers, impact wrenches, screwdrivers, nutsetters, drills, reamers and balancers are illustrated and described in 32-pp Catalog 62. Includes analysis of high frequency tools with a capsulized report on advantages of using 180, 360 or 400 cycle tools for specific applications. Thor Power Tool Co.
▲ For a copy, circle 147 on Post Card

Arc Welding Products — Bulletin 7000.7 is a 40-pp directory of arc welding electrodes, equipment and supplies. Arc characteristics, welding procedures, and physical properties are listed for each electrode including stainless steel, cast iron, and hardsurfacing types, as well as those for mild and low alloy, high tensile steel. The Lincoln Electric Co.
▲ For a copy, circle 148 on Post Card

Tube Cutters, Benders—Detailed information on tube fabricating equipment, including radius blocks and associated tube bending equipment is presented in 24-pp Catalog 4390. Includes specifications on tube cutters, flarers, benders, burring tools, counter-borers and other items and gives instructions for use of tools. Parker-Hannifin Corp.
▲ For a copy, circle 149 on Post Card

Clamp Assemblies—Illustrated and described in 12-pp Catalog JF-61 is a line of clamp assemblies and fixture components. Dimensional data and diagrams are included to facilitate selection. Accurate Bushing Co.
▲ For a copy, circle 150 on Post Card

Polishing, Buffing Machines—Semi-automatic polishing and buffing machines, including indexing machines, work holding spindle arrangements, rotary table machines, and manual and automatic roller feed machines, are illustrated and described in 20-pp Catalog AM-52. Describes accessories, attachments. Acme Mfg. Co.
▲ For a copy, circle 151 on Post Card

SAFETY

Protective Clothing—Illustrated and described in this product bulletin are Koroseal and rubber work suits, industrial raincoats, Hycar storm suits, and other outfits. Selection data included. B. F. Goodrich Industrial Products Co.
▲ For a copy, circle 152 on Post Card

Safety Gloves, Clothing—This ring-bound safety catalog covers asbestos and welder's gloves, finger guards, rubber gloves, hand pads, arm guards, work suits, aprons, boots, first aid equipment and other items. Included is a chart showing recommended gloves for chemical usages. Advance Glove Mfg. Co.
▲ For a copy, circle 153 on Post Card

MECHANICAL POWER TRANSMISSION

Variable Speed Drive—A self-contained variable speed drive, including an a-c motor, variable pitch pulleys, and a gear reduction unit in a single housing, is featured in 88-pp Catalog G-100. Dimension diagrams and charts for over 100 different assemblies are included, as well as full rating tables and additional output speeds. Reliance Electric & Engineering Co.
▲ For a copy, circle 155 on Post Card

Solenoid Brakes—Bulletin GEA-1518D discusses use of Thrustor and solenoid-operated spring-set two-shoe brakes. Describes adjustable braking torque, smooth braking action, low maintenance, and time delay for floor or motor mounting on either a-c or d-c motors. General Electric Co.
▲ For a copy, circle 156 on Post Card

V-Belt Clutch—Featured in 8-pp Catalog 40 are lever action clutches for a variety of industrial applications. Includes specifications and selection information, optional shaft requirements, pulley sizes, actuating devices, and applications for general purpose and other clutches. V-Belt Clutch Co.
▲ For a copy, circle 157 on Post Card

Belt Interchange Guide—This interchange guide lists outside circumference, top width and number of links of company's variable speed belt required for equivalent sizes of Dayton, Gates and other rubber belts and Reeves wood block belts. Data on how to measure, install and how to compute price, given. Manheim Mfg. & Belting Co.
▲ For a copy, circle 158 on Post Card

ELECTRICAL

Dry-Type Transformer—Comprehensive information on single phase, three phase and phase changer dry type transformers is presented in 36-pp Bulletin 102-261. Includes transformer photos, wiring diagrams, specifications and prices. Atlantic Transformer Co.
▲ For a copy, circle 159 on Post Card

Load Control Systems — Bulletin GET-2916B describes load control systems for industrial plants which generate all or part of their electrical requirements. Describes tie-line and frequency control, reactive power control and power limiting control, and includes schematics and specifications. General Electric Co.
▲ For a copy, circle 160 on Post Card

Postage-free cards for ordering Bulletins are on facing page. You may also use the cards to order literature mentioned in the ads.

Motor Control Center—Features and advantages of a motor control center which consists basically of an assembly of safety jack combination starters on a free-standing vertical section are detailed in this 8-pp bulletin. Describes components and illustrates typical installations. The Rowan Controller Co.
▲ For a copy, circle 161 on Post Card

Door Interlock Switches—Illustrated and described in Data Sheet 186 are door interlock switches for use as safety devices on hazardous electronic equipment. Includes mounting dimension drawings, mechanical characteristics, electrical ratings. Micro Switch, Div. Minneapolis-Honeywell Regulator Co.
▲ For a copy, circle 162 on Post Card

Precision Switches—Twenty-pp Catalog 104 covers a representative selection of products from company's line of precision switches for industrial, data processing, electronic and other applications. Contains photos and condensed descriptions of over 200 items, including miniature switches, special purpose types, electronic switch-circuit assemblies, lighted pushbutton switches, toggle switches. Micro Switch, Div., Minneapolis-Honeywell Regulator Co.
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Switchboard Instruments—Bulletin GEZ-3308, 12-pp, describes low-cost Type AB-30 and DB-30 switchboard instruments. Includes information relating to ranges covered, instrument burden data, dimensions and panel

BULLETINS

(Begins on page 21)

drilling layouts plus external connection diagrams and other pertinent data. General Electric Co.
▲ For a copy, circle 164 on Post Card

Current Limiting Fuses—Bulletin GEA-6319D, 8 pp, describes application, operation and features of company's Class J, H and L current limiting fuses for short circuit and overcurrent protection as applied to motor control centers, etc. Contains photos, curves, dimensional drawings and ratings. General Electric Co.
▲ For a copy, circle 165 on Post Card

Fault Indicators—Described in Bulletin SP3 are fault indicators designed for indication of faults on underground distribution systems. Covers application, features, and ordering details. Line Material Industries, McGraw-Edison Co.
▲ For a copy, circle 166 on Post Card

Current-Limiting Reactors—Cast-in concrete reactors for use on electric utility and industrial plant distribution systems rated 34,500 v and below are illustrated and described in 16-pp Bulletin GEA-976E. Includes data on ratings and dimensions. General Electric Co.
▲ For a copy, circle 167 on Post Card

Portable Test Sets—Illustrated and described in this product bulletin are portable high current test sets for continuous electrical protection. A number of different models for various applications are described. Multi-Amp Electronic Corp.
▲ For a copy, circle 168 on Post Card

For Hazardous Locations—Condulets for hazardous locations are illustrated and described in 60-pp Bulletin 2722. Code articles 500-503, and 510-517 are quoted, along with recommendations for condulets meeting various requirements. More than 300 product photos, installation photos and drawings are provided. Book is a valuable reference for planning electrical installations in hazardous areas. Crouse-Hinds Co.
▲ For a copy, circle 169 on Post Card

PUMPS, COMPRESSORS

Chemical Handling Pump—Horizontal end-suction centrifugal pumps featuring maximum interchangeability of parts are described in 16-pp Bulletin 725.8. Applications in chemical processing are detailed, and specifications, bearing life information, sectional views, composite curves and dimensional details included. Goulds Pumps, Inc.
▲ For a copy, circle 170 on Post Card

Liquid Blending Systems—New concepts in continuous line blending are detailed in 8-pp Bulletin 650. Explains advantages and operating principle, and includes schematic layout of components and case histories. Blackmer Pump Co.
▲ For a copy, circle 171 on Post Card

Packaged Compressors—Operational and design features of manufacturer's packaged compressor stations suitable for field gas gathering, gas lift, repressuring, recycling, plant feeders, refining, secondary recovery, gas transmission, multi-service and other applications are detailed in 6-pp Bulletin 191. Cutaway view, specifications and dimensions are included. Clark Bros. Co.
▲ For a copy, circle 172 on Post Card

Water-Cooled Compressors—Bulletin LA-1 describes company's LA and LB vertical water-cooled compressors — the LA for operation at normal plant pressures, and the LB for high pressures. Sectional views and specification for several models are included. Gardner-Denver Co.
▲ For a copy, circle 173 on Post Card

METAL FINISHING

Metal Finishing Automated—Machines and equipment designed to automate metal finishing operations are described and illustrated in 29-pp Catalog 160. Covers electrical conductivity, approximate current carrying capacity and comparative temperatures of metals and alloys, surface-weight tables for round steel rods and sheet steel, methods for computing work loads, machinery requirements. The Meaker Co.
▲ For a copy, circle 174 on Post Card

Finishing, Processing Equipment—Industrial Equipment Catalog A-661 illustrates a wide range of finishing and processing equipment and systems. Presents metal cleaning, surface preparation, pickling or rustproofing; spray booths; drying, baking and processing ovens; special processing equipment; control components; dust and fume-control equipment. The R. C. Mahon Co.
▲ For a copy, circle 175 on Post Card

For Ultrasonic Cleaning—Extensive information on physical properties of commonly used cleaning chemicals is presented in 14-pp Bulletin S-700. Designed to help users of ultrasonic equipment select chemicals best suited for a specific cleaning problem, it divides cleaning media into two groups—aqueous solutions and solvents— and includes such data as concentrations, operating temperatures. Branson Instruments, Inc.
▲ For a copy, circle 176 on Post Card

Electroplating Processes—Solution preparation, type of deposits, operating conditions, equipment required, and applications are among the subjects covered in 24-pp Bulletin EP-103 on electroplating processes. Nineteen plating and other metal finishing processes and procedures are covered. Hanson-Van Winkle-Munning Co.
▲ For a copy, circle 177 on Post Card

Barrel Plating Equipment—Manual and automatic barrel plating equipment is featured in this 16-pp bulletin. Major plating barrel specifications, photos and recommendations for barrel assemblies, horizontal barrel units, loading stands, storage and transfer units and final rinse units are included. The Udylite Corp.
▲ For a copy, circle 178 on Post Card

BOILERS

Heating Boilers—Eight-pp Bulletin 649B contains tabulated data on ratings and dimensions of company's boilers for low pressure heating of commercial and industrial buildings. Also covers features, typical specification and selection of heating coils and induced draft fans. American-Standard Industrial Div.
▲ For a copy, circle 179 on Post Card

Side-Fired Boiler—Advantages of this side-fired packaged boiler designed to provide more usable floor space are outlined in Bulletin A-103. Cutaway view showing internal features is included, along with specifications, dimensions. Eclipse Boiler Div., Eclipse Fuel Engineering Co.
▲ For a copy, circle 180 on Post Card

PIPING, VALVES, TRAPS

Transite Pressure Pipe—Installation Guide for Transite Pressure Pipe, TR-62A, contains 24 pp of detailed information on handling and installation of Transite pipe, from loading and unloading through such operations as assembly of pipe and couplings, cutting and machining, design of thrust blocks, service connections, backfilling and tamping. Johns-Manville Corp.
▲ For a copy, circle 181 on Post Card

Fire Safe Ball Valves—Described in this product bulletin are "fire safe" ball valves for hydrocarbon service at process temperatures below 400 F. Advantages are detailed along with specifications. The Jamesbury Corp.
▲ For a copy, circle 182 on Post Card

Solenoid Valves—High pressure solenoid valves for precise control of hydraulic systems are described in 20-pp Catalog 2002. Design and performance features are detailed and dimensional diagrams and pressure drop charts included. Waterman Hydraulics Corp.
▲ For a copy, circle 183 on Post Card

Valves and Regulators—Presented in this 74-pp condensed catalog is detailed selection information on company's line of solenoid valves, strainers, suction stop valves, back pressure regulating valves, and others. Includes capacity tables, installation instructions. Hubbell Corp.
▲ For a copy, circle 184 on Post Card

Steam Trap Selector—This 32-pp impulse steam trap selector for petroleum processing equipment contains detailed information on how to select, size and install steam traps. Includes trap recommendations, capacity tables, piping diagrams. Yarnall-Waring Co.
▲ For a copy, circle 185 on Post Card

OTHER EQUIPMENT

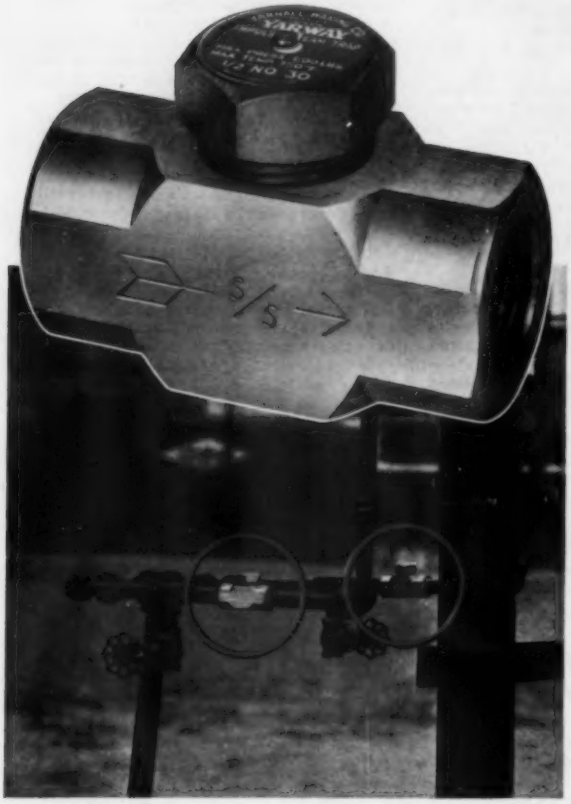
Microwave System—This 12-pp bulletin describes a flexible microwave system for low-cost transmission, such as telephone, telegraph, teleprinter, protective relaying and telemetering, supervisory control, monitoring, data and other communication signals. Performance specifica-

YARWAY news briefs

from **Yarnall-Waring Company,** *Philadelphia 18, Pa.*

BRANCH OFFICES IN 19 UNITED STATES CITIES • SALES REPRESENTATIVES THROUGHOUT THE WORLD
STEAM TRAPS STOCKED AND SOLD BY 270 LOCAL INDUSTRIAL DISTRIBUTORS

YARWAY SERIES 30 IS THE STEAM TRAP FOR PEAK EFFICIENCY



Two Yarway Series 30 traps on tracer lines from a loading station to polystyrene storage tank at the Midland Division of The Dow Chemical Co., Midland, Mich. Steam pressure is 150 pounds.

on tracer lines, main drips, meter boxes and other steam equipment

Yarway Series 30 Impulse Steam Trap has won enthusiastic acceptance and scored outstanding success on those hundreds of applications where condensate is handled in moderate amounts. Here's why:

- Economy of operation, with closer condensate control
- Longer service life, with lever action reducing impact on valve seat
- Lower maintenance, with easily and quickly replaceable seat and disc
- High quality, all stainless steel—combined with a new low cost

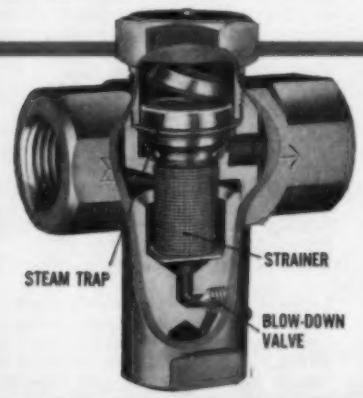
Here are a few typical user experiences:

TEXAS REFINERY—*Been using ½" No. 30's on drip legs to steam lines for 6 months. "No troubles whatsoever."*

PENNSYLVANIA TIRE MFR.—*Gradually replacing all traps on tire molds with Yarway No. 30's. "Amazed at their performance."*

MISSOURI STEEL PLANT—*Tested Yarway No. 30's against competitive traps, with result "Yarway No. 30 now standard on all main steam header drips."*

So it goes in plant after plant. Why don't *you* try Yarway Series 30 Traps? Available in ⅜" or ½" size; pressures 8 to 600 psi. Your nearby Industrial Distributor carries them. Write for his name.



NEW! COMPACT COMBINATION

NEW SERIES 130 steam trap combines a Series 30 trap, a strainer, and blow-down valve *all in one compact unit*—with these advantages:

- Saves space
- Saves installation costs
- Saves weight
- Saves on maintenance

Stainless steel construction, good for all pressures 8 to 600 psi.

Your Yarway distributor has SERIES 130 traps. Try one today—or write for new Bulletin T-1743-B.

For more facts circle 641 on Reply Card

BULLETINS

(Begins on page 21)

tions and ordering information included. Lynch Communication Systems Inc.
▲ For a copy, circle 186 on Post Card

Dry-Type Filter—Eight-pp Bulletin 228 describes a dry-type unit air filter combining compactness with high efficiency, low resistance and large dust-holding capacity. Applications, construction, installation, operation and holding frame arrangements are detailed, and dimensional drawings, performance data, space requirements and specifications included. American Air Filter Co., Inc.
▲ For a copy, circle 187 on Post Card

Stock Packings—Fabric, foil, plastic and filament packings for a variety of industrial applications are featured in this 8-pp catalog and price list. Lists recommended applications along with dimensional data. Greene, Tweed & Co.
▲ For a copy, circle 188 on Post Card

Anti-Scorching Lubricant — Extreme pressure anti-scorching lubricant, for machine tool and other manufacturing processes, is described in this product bulletin. Applications in such operations as lathe centers, steady rests, thrust bearings, broaching, extruding, swaging, die-set posts, cams, machine ways described. Chicago Mfg. & Distributing Co.
▲ For a copy, circle 189 on Post Card

Equipment Leasing—Advantages of leasing equipment are detailed in this 6-pp booklet in terms of increased profits and operating facilities. Explains how leasing equipment plan frees working capital for expansion and development. National Equipment Rental, Ltd.
▲ For a copy, circle 190 on Post Card

Concrete Additive—Described in 6-pp Bulletin X-5a are products for improving concrete and other masonry products, including Pozzolith, a water-reducing admixture for concrete. Includes performance and estimating data. The Master Builders Co.
▲ For a copy, circle 191 on Post Card

Keys to Steel Satisfaction—Design, steel selection and heat treatment are described as the three keys to optimum economy and material performance in this 77-pp manual on steels. Separate sections on design, steels and treatment, contain basic information on increasing endurance limit of properly-selected steels through combination of sound design principles and good heat treatment. Climax Molybdenum Co., Div. American Metal Climax, Inc.
▲ For a copy, circle 192 on Post Card

Air Conditioning Silencers—Features and advantages of air conditioning silencing products are detailed in Form 2166. Among the equipment covered are sound traps, return air vent silencers, cooling tower silencers, others. Koppers Co., Inc.
▲ For a copy, circle 193 on Post Card

Silver Brazing Alloys—Illustrated and diagrammed, 24-pp Form ADC-847C discusses brazing procedures, problems and solutions. Covers silver brazing alloys—from those in standard rod forms to the Fluxcor type which incorporate fluxing agent in center of wire—their advantages and applications. Air Reduction Sales Co., Div. Air Reduction Co., Inc.
▲ For a copy, circle 194 on Post Card

Tube-Type Lubricant—How measured lubrication in handy tubes helps avoid bearing failure in electric motors and generators is explained in Bulletin 2101. Tables list recommended amounts of pre-measured lube-in-tube for various types of motors. Fairbanks, Morse & Co.
▲ For a copy, circle 195 on Post Card

Hinged Closures — Quick-opening hinged closures for blanking off pipeline ends and tank or vessel openings are described in 6-pp Bulletin TT-1034. Illustrations of typical installations and charts giving dimensional specifications included. Tube Turns, Div., Chemetron Corp.
▲ For a copy, circle 197 on Post Card

Autoclave System—Eight-pp Bulletin SW 161 describes an autoclave system for curing concrete blocks. Various components—autoclaves, condensate tanks, fired heaters, doors, and controls—are illustrated, as well as several types of pressure vessels. Struthers Wells Corp.
▲ For a copy, circle 198 on Post Card

Banding Clamps—Featured in 24-pp Form B-5 are industrial clamps of all diameters formed from continuous roll of band. Illustrates and describes banding tools and accessories, methods of application, and includes detailed specifications. Band-It Co.
▲ For a copy, circle 199 on Post Card

Parking Lot Manual—This 1961 Edition of 40-pp "How to Lay Out a Parking Lot" contains detailed sketches and photos of a variety of parking lot plans, including layouts for parking at 90-deg, 60-deg, and 45-deg angles, with recommended individual stall dimensions, aisle widths, and entrance and exit sizes. Several parking patterns are covered in detail. Mechanical aids, such as electric parking gates, electronic vehicle detectors, ticket printers described. Available to qualified plant engineers. Western Industries, Inc.
▲ For a copy, circle 200 on Post Card

For Quiet Telephoning—Open construction telephone booths designed for use in noisy areas are illustrated and described in this product bulletin. Features and advantages are detailed. Burgess-Manning Co.
▲ For a copy, circle 201 on Post Card

Industrial Odor Control—Methods of industrial odor control and selection of counteractant odors against specific malodors are detailed in this 16-pp bulletin. Covers plant odor control as well as product odor control. Rhodia Inc.
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DATA FILE OF LITERATURE FOR THE PLANT ENGINEER'S LIBRARY

STANDARD CATALOGS, bulletins and handbooks are described here to help plant engineers maintain a permanent data file. To order this free literature, use the Reader Service Cards provided on pages 217 and 218.

MATERIALS HANDLING

Coil Chain Hoist—Featured in 12-pp Bulletin ADH-65r is a portable, lightweight coil chain electric hoist with pushbutton control. Advantages of the Quik Lift are detailed and features shown. Coffing Hoist Div., Duff-Norton Co.
▲ For a copy, circle 301 on Post Card

Electric Hoists—Six-pp illustrated Bulletin 905 describes R&M Type J electric wire rope hoists in capacities of ¼, ½, 1 and 2 tons. Shows complete specifications including mounting options and sectionals. Hoist & Crane Div., Robbins & Myers, Inc.
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For Overhead Handling—Booklet 2008-Q, 12-pp, provides engineering and application information on overhead materials handling. Carriers, cranes, tractors, track switches, grabs, electrification are described. Detailed studies of track design, given: photos. Cleveland-Tramrail Div., The Cleveland Crane & Engineering Co.
▲ For a copy, circle 303 on Post Card

Portable Electric Hoists—Eight-pp Bulletin 15010 describes push button or pull cord control portable electric hoists. Cutaway views showing component features are included. Manning, Maxwell & Moore, Inc.
▲ For a copy, circle 304 on Post Card

Sheet, Coil Lifters—Detailed information on all types of sheet and coil handling lifters and related equipment is presented in 24-pp Bulletin SL-32. Applications are shown through photos and diagrams. Cullen-Friestedt Co.
▲ For a copy, circle 305 on Post Card

Vertical Transportation—Selection of vertical transportation for every traffic-moving job is detailed in 32-pp Bulletin A-382. Various types of elevators and escalators are described. Otis Elevator Co.
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Let's Keep Rolling Ahead

DATA FILE

(Begins on page 222)

Roller, Wheel Conveyors—Catalog 158 contains 68 pp of comprehensive data on roller and wheel conveyors for a variety of applications. Profusely illustrated with dimensional diagrams and photos of typical installations, catalog also gives load rating tables. Mathews Conveyer Co.
▲ For a copy, circle 307 on Post Card

Self-Dumping Hoppers—Cost-saving advantages of self-dumping steel hoppers for bulk material handling are detailed in Bulletin 265. Photos showing typical handling applications are included. Roura Iron Works, Inc.
▲ For a copy, circle 308 on Post Card

Conveyor Chains—This 38-pp engineering reference book contains comprehensive information on selection of chain for conveying and elevating. Correct application of chains to conveyor systems, development of attachments to increase their versatility and factors in selecting chains are outlined and a trouble shooting chart included. Moline Malleable Iron Co.
▲ For a copy, circle 309 on Post Card

ROPE, SLINGS, CHAINS

Sling Chain Handbook—Illustrated Data Book 100, 32-pp, presents "how to do it" information on sling chains—from ordering to care, use and inspection. Covers standard and special styles. Columbus McKinnon Corp.
▲ For a copy, circle 310 on Post Card

Sling Chains—Price List 512 contains 24 pp of detailed ordering data on sling chains and related materials handling items. Specifications are listed along with prices, tips on care and inspection. American Chain Div., American Chain and Cable Co., Inc.
▲ For a copy, circle 311 on Post Card

Wire Rope and Slings—Abuses that shorten the life of wire rope and slings are graphically described in this 28-pp handbook. Abuses and correct uses are illustrated with cartoon caricatures and the booklet packed with rope and sling saving information. Union Wire Rope Corp.
▲ For a copy, circle 312 on Post Card

Wire Rope Data—Condensed Bulletin 6025 lists up-to-date weights and strengths of both improved plow steel and extra improved plow steel. Also describes wire rope constructions. Macwhyte Wire Rope Co.
▲ For a copy, circle 313 on Post Card

Wire Rope Selection Tips—This 16-pp illustrated booklet, "How To Be A Wire Rope Expert," describes basic principles governing selection of proper rope construction. Describes five factors to be considered and shows how these can be balanced for best possible efficiency regardless of application. Leschen Wire Rope Div., H. K. Porter Co., Inc.
▲ For a copy, circle 314 on Post Card

CONSTRUCTION

Open Web Joists—Standard and long span open web steel joists are illustrated and described in this 38-pp catalog. Advantages of the steel joist construction are detailed, and sections are included on design calculation, properties. American Bridge Div., United States Steel Corp.
▲ For a copy, circle 315 on Post Card

Screw Fastening of Aluminum—This 48-pp technical handbook covers various types of standard and special fasteners and fastening systems used to join aluminum assemblies. Supplemented with numerous illustrations and tables, it includes list of manufacturers of special screw fasteners. Reynolds Metals Co.
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Good Grouting Methods—Text and photos in 8-pp Bulletin EPMG-2a, explain proper methods for grouting different types of heavy industrial equipment. Non-shrink Embeco premixed grout is used to explain methods and techniques. Preparatory steps shown. Master Builders Co.
▲ For a copy, circle 317 on Post Card

Asbestos-Cement Materials—Details on asbestos-cement building materials for interior and exterior use are presented in this product bulletin. Described are roof-decking, corrugated asbestos for roofing and siding, sidewall sheets, tiles, decorative panels, plastic-coated siding, and air-duct. Keasbey & Mattison Co.
▲ For a copy, circle 318 on Post Card

Movable Wall System—Illustrated and described in this 8-pp bulletin is a movable wall system designed to fit a variety of building requirements. Describes an acoustical wall as well as plywood and glass partitions, and covers finishes, surfaces, and sizes. Modern Partitions, Inc.
▲ For a copy, circle 319 on Post Card

Structural Clay Products—Descriptive information, photos and construction details on structural clay building materials are presented in 24-pp Catalog S-60. Characteristics and advantages of various types of facing tile, bricks, and other products are detailed. Natco Corp.
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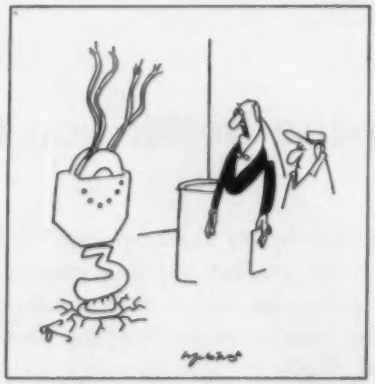

"I'll bet he has a headache tomorrow."

Structural Panels—Melamine coated panels and fiberglass panels for a variety of interior and exterior structural effects are illustrated and described in this 8-pp product bulletin. Barclite Corp. of America.
▲ For a copy, circle 321 on Post Card

Glass Blocks and Modules—Design flexibility and functional advantages of company's glass blocks and sculptured glass modules are described in 20-pp Bulletin GB-115. Includes technical data on light transmission, insulation value, physical performance. Pittsburgh Corning Corp.
▲ For a copy, circle 322 on Post Card

Acrylic Plastic Sheet—This 12-pp Booklet PL-415 describes properties and characteristics of Plexiglas acrylic plastic sheet. Applications in a variety of industries are illustrated. Rohm & Haas Co.
▲ For a copy, circle 323 on Post Card

Basic-Roofing Information—"What You Should Know About Your Roof" is a 40-pp clearly illustrated booklet which tells what makes a roof fail, how to recognize signs of roof deterioration, what to do to keep a roof in good condition. Discusses roofing practices. Johns-Manville Corp.
▲ For a copy, circle 324 on Post Card

Roofing Guide—This Manual 1136, 16 pp, describes and illustrates 14 common roof problems and recommends repairs and maintenance to overcome each. Covers flashing damage, alligatored, blistered, torn and open seams. Various roof types are discussed, and protection listed for each. The Monroe Co., Inc.
▲ For a copy, circle 325 on Post Card

Door and Frame Units—Illustrated and described in 20-pp Bulletin DHS-2060 are flush-design metal and wood doors, frames and hardware. Includes complete construction and specification data. Dusing and Hunt, Inc.
▲ For a copy, circle 326 on Post Card

Rolling Steel Doors—Illustrated and described in 16-pp Catalog G-60 are rolling steel doors designed to meet industrial and other requirements. Details features and engineering specifications of standard hand, mechanically and power-operated doors. The R. C. Mahon Co.
▲ For a copy, circle 327 on Post Card

Aluminum Sash—Illustrated and described in this product sheet is rigid welded sash made from aluminum extrusions. Advantages are listed. Butler Mfg. Co.
▲ For a copy, circle 328 on Post Card

Non-Slip Flooring—Algrip, an abrasive rolled steel floor plate described as non-slip even on steep inclines, is the subject of Booklet AL-29, 8-pp. Alan Wood Steel Co.
▲ For a copy, circle 329 on Post Card

Safety Floor Plate—Advantages of Multigrip floor plate designed for sure footing and positive traction under all conditions are detailed in 15-pp Bulletin ADUCO-17002-59. Tables list available sizes, thicknesses and weights, and show allowable uniform loads. U. S. Steel Corp.
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A Nalco PRODUCT MANAGER

Answers Questions about Steam Condensate Systems Corrosion . . . and How to Control It

Costs of Equipment Repair and Replacement Can Be Cut Drastically with a Sound Control Program

Industry still pays a huge annual bill for down-time, equipment replacement and repairs made necessary by steam condensate corrosion. Much of this cost can be eliminated by knowledge of what the problem is and action toward solving it. Here are answers to some basic questions that may be helpful to you.

Question: What does corrosion do in a steam condensate system?

Answer: Corrosion literally eats up the metal in the system from the inside. Piping, valves, pumps, and process equipment can be seriously damaged or ruined by corrosive condensate. Even boilers can be damaged by deposits resulting from metal oxides in corrosive returned condensate.

Question: What causes steam condensate corrosion?

Answer: Most condensate system corrosion is caused by carbon dioxide and oxygen, carried into the system with the steam. Carbon dioxide, dissolved in the pure condensed steam, forms corrosive carbonic acid. If oxygen is present with carbon dioxide, the corrosion rate is much higher, and is likely to produce localized pitting. Ammonia, in combination with carbon dioxide or oxygen, attacks copper alloys.

Question: What constitutes a corrosion prevention program?

Answer: There are three factors which should be examined in setting up a condensate corrosion-prevention program:

a. Softening, or other pretreatment of boiler feedwater should be designed to reduce the quantity of potential carbon dioxide that can be released from the boiler. Effective deaeration of feedwater also helps reduce oxygen content. Attention to both of these will make the final condensate corrosion prevention treatment more economical.

b. Mechanical design of the system should include such factors as maximum venting of corrosive gases, adequate velocities in lines, proper installation and maintenance of traps, and elimination of severe steam-impingement.

c. An effective chemical treatment program should be set up. Treatment may be either with a volatile amine chemical to neutralize carbon dioxide, or with a filming inhibitor which forms a protective barrier between the metal and the corrosive condensate.

Another important part of the chemical treatment program is continuous application of a fast acting chemical oxygen scavenger to the boiler feedwater.

Question: Can Nalco provide recommendations for a complete condensate control program?

Answer: Yes. Nalco will make a thorough survey and make recommendations for a complete corrosion control program.

Question: Which type of chemical treatment is best: volatile neutralizing amine or filming inhibitor?

Answer: This depends on the system to be treated. Plant layout and operating conditions, and the characteristics of boiler feedwater are some of the factors which should be taken into consideration. Generally,

James M. Seamon, Manager
Nalco Power Industry Chemicals Department

volatile amines are most desirable where low make-up volume, low feedwater alkalinity and good oxygen control exist. Filming inhibitors usually provide most economical protection in systems with high make-up, oxygen in-leakage, high alkalinity, or where the system is operated intermittently. In some plants, a combination of protective chemicals may be needed.

This is the area where Nalco know-how can result in thorough protection at minimum cost, by recommending a specific program to fit individual plant conditions.

Question: Isn't one condensate corrosion control chemical about the same as any other?

Answer: Definitely not. Both the volatile amines and filming inhibitors are complex chemicals—members of chemical "families" in which a nearly infinite variety of types is possible. Best treatment chemicals are those which offer the greatest protection in relation to their cost. Even though Nalco chemicals are now outstanding in results-per-dollar, Nalco research and development continues in order to improve this ratio.

Question: What help can Nalco provide in setting up and maintaining a condensate corrosion control program?

Answer: Your Nalco Representative has the technical training and experience to be of substantial assistance in setting up and maintaining an effective condensate corrosion control program. His service is backed by the facilities and experience of the entire Nalco organization. Where special problems occur, Nalco specialists are ready to help him find answers promptly.

Suggestion: Call your Nalco Representative, or write to me for further details on Nalco steam condensate corrosion control . . . or data on any aspect of modern water treating practices for better plant operating efficiency. James M. Seamon, Manager, Power Industry Chemicals Department.

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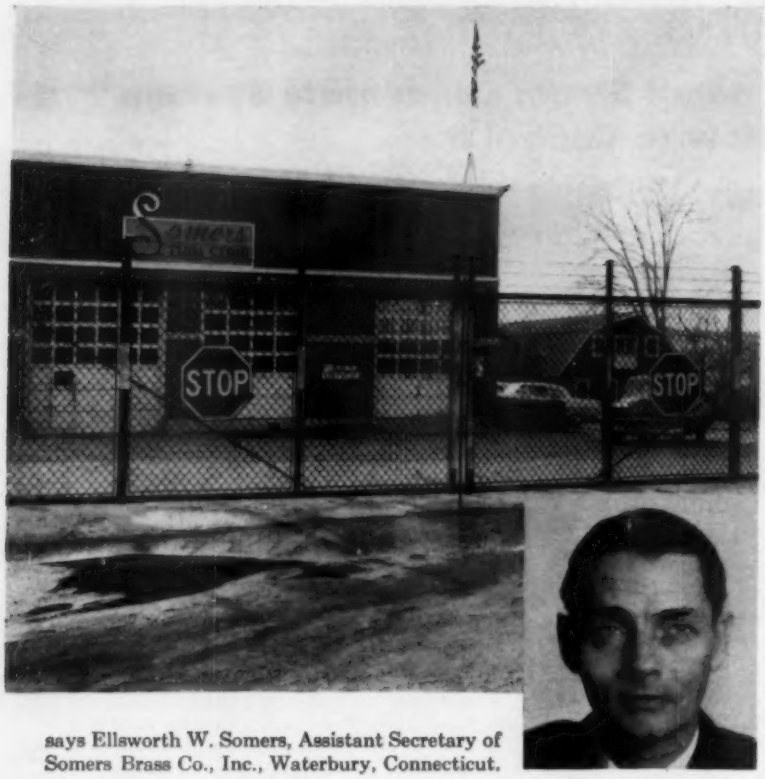

says Ellsworth W. Somers, Assistant Secretary of Somers Brass Co., Inc., Waterbury, Connecticut.

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DATA FILE

(Begins on page 222)

Stair Treads, Grating—Details on company's aluminum stair treads and grating featuring one-piece construction are presented in this Product Bulletin AD-679. Describes types of finishes, sizes and weights available. Aluminum Co. of America.
▲ For a copy, circle 331 on Post Card

Grating and Treads—Safety, visibility, permanence and easy maintenance are among advantages of open flooring discussed in 28-pp Bulletin 2527-R. Covers use of electro-forged grating in a wide range of industries also features grating applications. Information provided includes types and spacing. Blaw-Knox Co.
▲ For a copy, circle 332 on Post Card

Safety Grating—Steel, aluminum and stainless steel safety grating for a variety of industrial applications is featured in 24-pp Catalog 5911. Shows typical installations and includes erection. The Globe Co.
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STORAGE SHOP EQUIPMENT

Flexible Steel Shelving—Advantages of Erectomatic steel shelving are illustrated and described in 8-pp Form 2451-D. Various types of shelving available are shown and dimensional data given. Columbia-Hallowell Div., Standard Pressed Steel Co.
▲ For a copy, circle 334 on Post Card

Guide to Shelving—To assist plant engineers in selecting proper shelving for all storage requirements, 64-pp Catalog 30 offers detailed suggestions for correct shelving and storing materials, loose and packed parts. Storage cabinets are also described and instructions included for planning of stockrooms. Deluxe Metal Products Co., Royal Metal Mfg. Co.
▲ For a copy, circle 335 on Post Card

Storage Equipment—Reference Manual 487 contains 64-pp of descriptive data on a line of steel storage equipment, including shelving, bins, doors, slotted angle, drawer units, lockers, benches, grating, counters, and other items. Assembly details and dimensional data included. Equipto.
▲ For a copy, circle 336 on Post Card

Steel Equipment—Catalog 100 K contains 100 pp of detailed information on steel cabinets, folding chairs, work benches, tool stands, shelving, tool storage, lockers, coat racks, filing cabinets, revolving bins, others. Lyon Metal Products, Inc.
▲ For a copy, circle 337 on Post Card

MAINTENANCE

Paint Economy—Factors to consider in selecting paints are detailed in this sixth edition of "Engineered Color," 20-pp. Covers proper use of paint and color, requirements of various surfaces, color and the safety pro-

gram. Describes interior and exterior primers and finishes, varnishes and floor sealers. Includes color chips. Barreled Sunlight Paint Co.
For a copy, circle 338 on Post Card

Coatings for Industry—Detailed information on a variety of coatings for industrial application, including anti-corrosive coatings, decorative finishes, exterior wall and roof coatings, floor materials, fungus treatments, industrial coatings, interior wall coatings, roof coatings is given in 40-pp Catalog 59. Properties and application covered. Steelcote Mfg. Co.
For a copy, circle 339 on Post Card

Protective Coatings—Latest developments in corrosion resistant coatings, treatments for floors, and coatings and waterproofing for masonry are described in 72-pp Form 990. Presents detailed information on maintenance products for interiors, door coatings, exteriors, new construction, roofs. Truscon Laboratories, Div. Detroe & Raynolds Co., Inc.
For a copy, circle 340 on Post Card

Protective Coatings—This 38-pp comprehensive treatise (Form 259) on rust and corrosion control by protective coating contains a gate-fold spread showing actual color standards of company's primers and top coatings. Covering water resistant, heat-resistant, floor coatings, heavy-duty chemical resistant coatings, galvanized metal coatings, wire fence roller coatings, and quick-dry coatings, booklet contains 110 color chips. Rust-Oleum Corp.
For a copy, circle 341 on Post Card

Coating Systems—Described in this 16-pp bulletin are a number of protective maintenance coating systems designed to solve a variety of corrosive problems. Index tab indicates where a particular system should be applied. The Glidden Co.
For a copy, circle 342 on Post Card

Sulfamic Acid Cleaners—Scale dissolution rates for sulfamic acid cleaners, plus a diagram sheet showing simple equipment cleaning hookups are presented in this 8-pp product bulletin. Advantages of sulfamic acid cleaning are listed. E. I. du Pont de Nemours & Co.
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Steam Cleaners—This 12-pp catalog illustrates and describes steam cleaners and hydraulic pressure combination cleaning systems. Detailed specifications on each model included. Malsbary Mfg. Co.
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Industrial Vacuum Cleaning—Twelve-pp Bulletin 155 B describes both stationary vacuum cleaning equipment and portable industrial vacuum cleaners. Recent improvements in collection and dumping methods are also covered. Spencer Turbine Co.
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Vacuumized Sweeper—Advantages of a vacuumized sweeper designed to control dust without water are described in this Product Bulletin 85.55. Design and construction features are detailed, as well as mechanical data. G. H. Tennant Co.
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Pyramid Ladders—Catalog 159, 20-pp, describes a line of pyramid-design step ladders, as well as hydraulic lifts and fixed or adjustable-level work platforms for above-floor working safety. Illustrates 35 new models of ladders for working heights up to 15 ft. Ballymore Co.
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BOILERS, BURNERS

Hot Water Boilers—Featured in this Product Bulletin AD-183 is a line of hot water boilers with forced thermal circulation and high velocity tempering flow. Internal flow pattern is shown on cutaway, and design and test data given. Cleaver-Brooks Co.
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Steam Generators—Automatic packaged steam generators are featured in 18-pp Bulletin AA 2760. Analysis of boiler design factors is included along with detailed performance data, photos and a longitudinal section. Ames Iron Works, Inc.
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Steam Generators—Benefits of a totally controlled method of steam generation is explained in this 14-pp Product Bulletin 1018. Includes schematic explaining principle of controlled steam generation and a table of specifications. Clayton Mfg. Co.
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Boiler-Burner Plant—Bulletin 4 contains detailed information on Scotch type, two-pass boiler with attached burner unit designed for low pressure, 125 lb, or for 150 lb pressure. Table of data and dimensions is included. Industrial Combustion Inc.
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VALVES, TRAPS, FITTINGS

Stainless Steel Valves—Corrosion resistant stainless steel valves are featured in 32-pp Catalog 59SS. Features of design and construction are shown through cutaway views, and advantages of stainless steel in withstanding corrosive chemicals and atmospheres detailed. Jenkins Bros.
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Cast Steel Valves—High-pressure, high-temperature cast steel valves are described in this 6-pp Pressure-Seal bulletin. Dimensional data included. Walworth Co.
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Butterfly Valves—Resilient-seated type butterfly valves for applications where positive tight closure is required are illustrated and described in Bulletin 590X. Advantages are detailed. W. S. Rockwell Co.
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Feeders, Rotary Valves—Eight-pp Bulletin F-5A illustrates and describes roll and vane-type feeders and rotary valves for dry pulverized and granular materials. Photos and draw-

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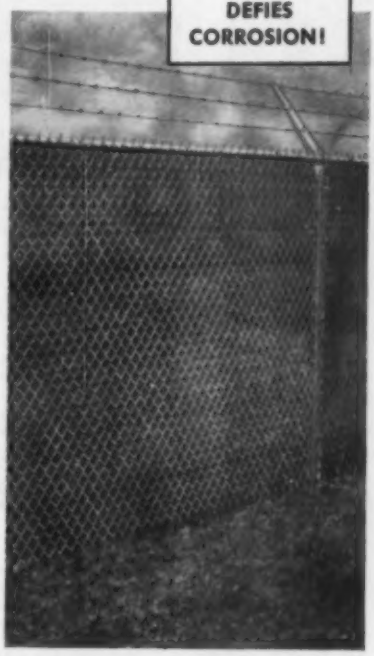

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DATA FILE

(Begins on page 222)

ings illustrate details and tables give sizes, capacities. Fuller Co.
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Pinch Valves—Construction features, and advantages of Massco-Grigsby pinch valves are explained and illustrated in 14-pp Catalog 609. Provides sleeve service recommendations and specifications for manual, motorized and hydraulic types. Mine and Smelter Supply Co.
▲ For a copy, circle 356 on Post Card

Steel Valves—Catalog 120 contains 42-pp of detailed information on cast and forged steel valves, including gate valves, check valves and globe valves. A table listing properties of ferritic and austenitic steels is included, as well as specifications and design data, dimensional diagrams. The Chapman Valve Mfg. Co.
▲ For a copy, circle 357 on Post Card

Blow-Off Valves—Unit-tandem blow-off valves for medium pressure boiler installations are featured in Bulletin B-435. Operation and design features are detailed, materials of construction given. Yarnall-Waring Co.
▲ For a copy, circle 358 on Post Card

Diaphragm Valves—Featured in 16-pp Catalog GAM-60 are diaphragm valves with air motors for application in controlling flow of gases, corrosives, abrasives, delicate fluids, and slurries. Includes air requirements charts, dimensional data, and schematics. Grinnell Co., Inc.
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All About Valves—Circular 606 entitled "What is a Valve?" is a 36-pp booklet detailing the four basic designs from which valves are developed. Basic materials from which valves are made—such as bronze, cast iron, steel and PVC—are illustrated, as are typical applications of valves. The Lunkenheimer Co.
▲ For a copy, circle 360 on Post Card

Valve Digest—Illustrated and described in 26-pp Catalog Digest CD-2 are gate, globe and angle, and check valves in bronze, iron, cast steel and forged steel. Describes features and advantages and includes valve dimension charts, pressure-temperature rating. The Ohio Injector Co.
▲ For a copy, circle 361 on Post Card

Valve Buyers Guide—Detailed information on bronze, steel and iron valves, and valves made of corrosion-resistant metals and alloys is presented in 24-pp Form 186. Covers angle valves, check valves, gate valves, globe valves, liquid level valves, lubricated plug valves, needle valves, others. The Wm. Powell Co.
▲ For a copy, circle 362 on Post Card

Steam Traps—This 1960 Condensed Catalog contains 12-pp of technical details, dimensions, and capacity data on steam traps, temperature regulators, and heating specialties. Cutaway views included. Sarco Co., Inc.
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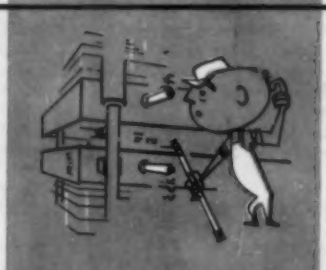
These costly pipe motion problems quickly corrected with **Flexonics** metal hose

Compressor and pump wear resulting from vibration and shock

Leaking pipes due to thermal expansion and contraction

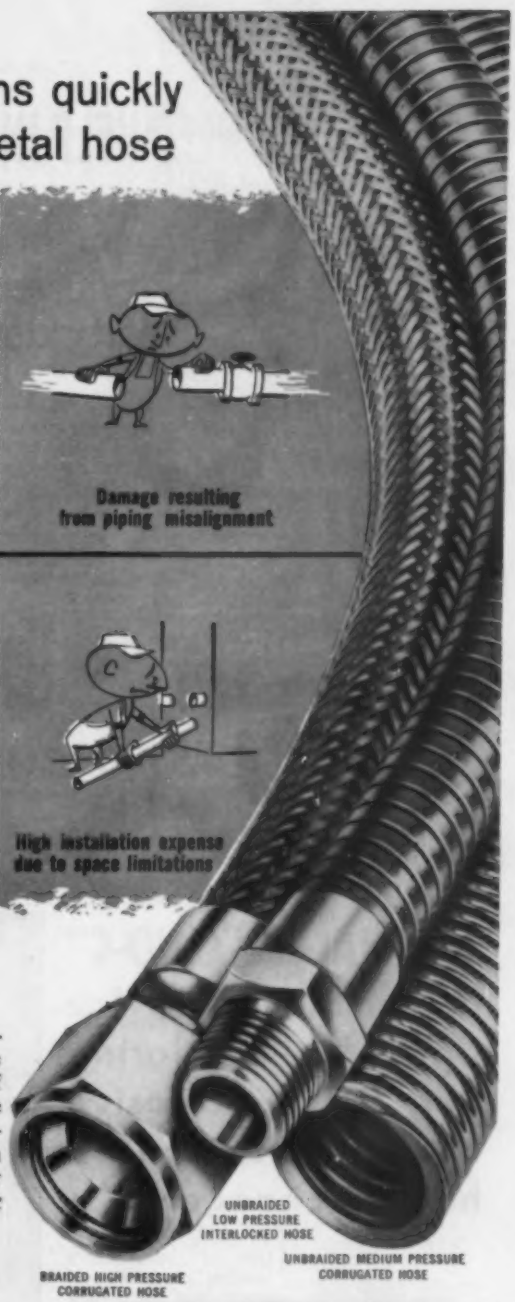
Damage resulting from piping misalignment

Piping changes necessitated by random motions



Providing for reciprocating motion

High installation expense due to space limitations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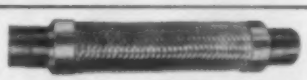

BRAIDED HIGH PRESSURE FLEXIBLE CONNECTOR

Flexonics

DIVISION OF CALUMET & HECLA, INC.
400 East Devon Avenue • Bartlett, Illinois

FLEXIBLE METAL and SYNTHETIC HOSE
EXPANSION JOINTS
BELLOWS • SPECIAL TUBULAR ASSEMBLIES

In CANADA
FLEXONICS CORPORATION OF CANADA, LTD.
BRAMPTON, ONTARIO

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Send free copy of Flexonics Metal Hose Product and Design Guide. Also send the name of your local distributor.

For more facts circle 648 on Reply Card

WHEN YOU NEED HELP IN A HURRY—

Koppers coupling service cuts costly down-time

Not every coupling service need is an emergency. But it's the emergencies that really test a good organization. That's why Koppers maintains experienced field engineers and outstanding stock facilities throughout the country. In addition, if it's a Fast's Coupling you're replacing, we have a serial number and specific application history for every Fast's for easy reordering. And our modern manufacturing facilities have the extra capacity to lick an emergency for special requirements.

Example: A modern windowless bank in Georgia was able to open for business as usual only because Koppers flew in a completed replacement coupling for its air conditioning unit. Elapsed time . . . request phoned to Baltimore after 10 in the evening . . . coupling arrived before 7:30 next morning.

KOPPERS COMPANY, INC., 1005 Scott St., Baltimore 3, Md.

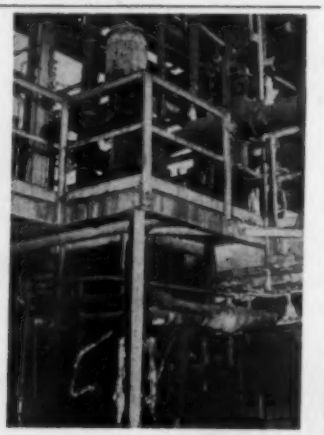
KOPPERS

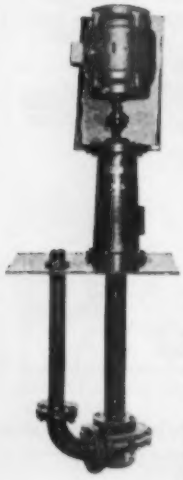
FAST'S COUPLINGS

Engineered Products Sold with Service

For more facts circle 649 on Reply Card

This NAGLE "CWO-C" is just the pump for this job—circulating hot, sticky, corrosive chemicals through a heat exchanger!





One of the nation's leading producers of paints and component materials for paints, reports highly satisfactory performance from the Nagle 2½" type "CWO-C" pump, shown in their plant. It is circulating crude cresol through a heat exchanger to effect the vaporization of the cresol.

The crude cresol stock is composed of tars, inorganic salts, water and the desired cresols. There are no bearings in or near the hot, viscous material being pumped—all bearings are above the floor plate. There is no rubbing contact between stationary and moving parts below the radial bearing. Water end parts are resistant to abrasion, mild corrosion and heat. Bottom entrance eliminates troubles from materials congealing in casing when pump is idle. Unit above has pedestal mounted motor—other arrangements such as bracket mounted motor on "CWO-C" pump at left are available. Send for Nagle Pump Selector. **Nagle Pumps, Inc.**, 1267 Center Ave., Chicago Heights, Ill.

Tough jobs call for

Nagle PUMPS

FOR ABUSIVE APPLICATIONS EXCLUSIVELY

For more facts circle 650 on Reply Card

DATA FILE

(Begins on page 222)

On Steam Traps—Catalog K is an enlarged 48-pp manual and steam trap catalog. New material provided includes open float and thermostatic traps, pipe strainer to 6 in. steel and semi-steel and helpful steam pipe sizing tables. Discusses fundamentals of trapping, trap selection, installation. Armstrong Machine Works.
▲ For a copy, circle 364 on Post Card

Steam Trap Primer—Fundamental facts about drainage and steam trap operation are presented in this 16-pp steam trap primer. Operating principles of steam traps are fully detailed, and data on steam trap maintenance and application included. Barnes & Jones, Inc.
▲ For a copy, circle 365 on Post Card

Trap Strainers—Eight-pp Bulletin 601 contains a chart listing case histories of typical trap strainer applications. Strainer size, materials of construction, metallic straining media, housings, screens flanges, and connections for specific uses listed. Multi-Metal Wire Cloth Co., Inc.
▲ For a copy, circle 366 on Post Card

Unions, Valves and Fittings—Contained in ring-bound Catalog U-601 is detailed literature on unions, valves and fittings of forged steel for all types of industrial applications. Contains listings of popular unions with their technical ratings, details of construction. Clayton Mark & Co.
▲ For a copy, circle 367 on Post Card

Plumbing, Heating Specialties—Protection and control specialties for plumbing and heating systems are illustrated and described in 12-pp Condensed Catalog C-60. Describes automatic temperature and pressure relief valves, temperature relief valves, gas shutoff valves, vacuum relief valves, others. Watts Regulator Co.
▲ For a copy, circle 368 on Post Card

Plastic Pipe—Characteristics and advantages of company's plastic pipe are detailed in Bulletin TR-273A. Contains tabular data on physical properties, rated working pressures, weights. Johns-Manville Corp.
▲ For a copy, circle 369 on Post Card

Piping Products—Use of this company's coupling, fittings and other piping products is described in 8-pp Form 259. Contains product information, installation instructions, specifications, illustrations of such applications as fuel and supply lines, materials handling piping. Dresser Mfg. Div., Dresser Industries, Inc.
▲ For a copy, circle 370 on Post Card

Sewer Structures—Structural and material advantages of corrugated sewer pipe are detailed in 44-pp Manual CMS-7458. Discusses structural durability of corrugated metal sewers, material durability, selection of structures, factors influencing capacity, joints and fittings, linings for

failing sewers, installation data. Armco Drainage & Metal Products, Inc.
▲ For a copy, circle 371 on Post Card

HOSE

All-Purpose Hose—Illustrated and described in Bulletin A-5157K is an all-purpose hose designed for air, oil, gasoline, chemicals and water applications. Advantages and economies told. Goodyear Tire & Rubber Co.
▲ For a copy, circle 372 on Post Card

Flexible Metal Hose—Featured in 8-pp Catalog 188 is a line of flexible metal hose, as well as rubber and synthetic hose. Flexonics Corp.
▲ For a copy, circle 373 on Post Card

MECHANICAL POWER TRANSMISSION

Multiple V-Belt Drives—Catalog DH-901, 24 pp, lists advantages and features of the HC V-belt drive designed to reduce drive costs and take up 50 per cent less space. Ratings, installation information and drive selection tables. The Gates Rubber Co.
▲ For a copy, circle 374 on Post Card

Screw Conveyor Drives—Bulletin 7106 presents 20 pp of data on screw conveyor drives for applications in range from ½ to 30 hp, in four ratios, designed to bolt to standard trough ends. Design features and accessories described. The Falk Corp.
▲ For a copy, circle 375 on Post Card

Frequency-Controlled Speeds—Illustrated with schematic drawings and application photos, 8-pp Bulletin F-1963 explains company's Varidyne principle whereby any a-c motor is converted to variable speeds by varying frequency of a-c supplied to motor. U. S. Electrical Motors, Inc.
▲ For a copy, circle 376 on Post Card

Grommet V-Belts—Advantages of company's grommet V-belts are illustrated and described in this 8-pp bulletin. Belt features are fully described and tips on how to figure a drive given. Goodall Rubber Co.
▲ For a copy, circle 377 on Post Card

Magnetic Pulleys—Factors governing selection of electromagnetic pulleys or non-electric ceramic type pulleys are explained in 8-pp Catalog C-2000. Covers applications, and includes detailed chart on selection. Dings Magnetic Separator Co.
▲ For a copy, circle 378 on Post Card

Shaft-Mounted Reducers—Bulletin 60 contains over 66 pp of selection tables on shaft-mounted speed reducers and screw conveyor drives. Advantages and construction details are discussed for torque-arm reducers, flange mounted reducers and screw conveyor drives, and installation information included. Dodge Mfg. Corp.
▲ For a copy, circle 379 on Post Card

Anti-Friction Bearings—Catalog 424-D covering "the broadest line in the anti-friction field," is an 8-pp folder giving capsule presentation of com-

A clean plant is a Safe Plant with Stonehouse Signs

Enlist employee aid in keeping your plant clean, sanitary, and safe by the use of INDUSTRIAL GOOD HOUSEKEEPING SIGNS by STONEHOUSE.

All Stonehouse Signs are designed and manufactured to accomplish this purpose in the most effective manner. They are of the highest quality workmanship and materials and comply fully with American Standard Specifications.

Hundreds of different stock-worded accident-prevention signs are available for prompt shipment. Usually the same day your order is received.

NOTICE
EQUIPMENT IN YOUR DEPARTMENT MUST BE THOROUGHLY CLEANED AFTER EACH DAYS WORK

PLEASE HELP KEEP THIS PLACE CLEAN

NOTICE
DUMP NO RUBBISH -HERE-

Signs Since 1863

Write today for our free, full-color, 64-page catalog, plus information about custom-printed signs to meet your specifications.

Stonehouse SIGNS

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9th and Larimer Streets, Denver 4, Colorado

For more facts circle 651 on Reply Card

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Multi-Carbide Tipped Rotary MASONRY BITS

Stock Sizes ¼" to 6" diameters. Larger diameters up to 14" available on request.

Advanced, *Free Cutting* design for fast, low cost drilling in any masonry from hard brick and tile to hard concrete . . . even with reinforcing rods.

Better because:

1. Individual spiral flute for each cutting tip assures positive dust removal from the cutting zone.
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3. All cutting edges are precision ground—all teeth on the same plane.
4. Specially selected grade of carbide for each cutting tip.
5. Heat treated alloy steel body and shank for longer bit life.

NEW ENGLAND CARBIDE

Cyclo-Core®
MASONRY BITS
may be used in
ELECTRIC ROTARY IMPACT DRILLS
such as STANLEY, SKIL, SYNTRON, BOSCH, etc.

AVAILABLE AT YOUR INDUSTRIAL DISTRIBUTOR
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Please send me free copy of your "DRILLING REINFORCED CONCRETE" Brochure

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For more facts circle 652 on Reply Card

FITS ANY LIFT TRUCK DUMPS AUTOMATICALLY

CAN CUT HANDLING COSTS 50%

With this self-dumping hopper on your lift truck, one man can do the work of two—in a fraction of the usual time. It's the modern, low-cost way to handle scrap metal, small castings, cinders, punch press parts, hot forgings, cullet—all kinds of bulk material.

DUMPS ITSELF

RIGHTS ITSELF

LOCKS ITSELF

Attaches in seconds to any lift truck—fork or platform. Can't slip off. Operator picks up loaded Hopper—transports it to its destination—releases the latch—and the Hopper automatically dumps its load, rights itself, locks itself.

Roura Hoppers are sturdily made of 3/16" steel plate with continuous arc-welded seams. Heavier plate if desired, also stainless steel or galvanized. Made in eight sizes, 1/4 to 4 yard capacities, mounted on live skids or a choice of wheels. Standard models available for immediate shipment.

ROURA
Self-Dumping
HOPPER

WANT MORE DETAILS? Just clip this coupon to your letterhead and mail to
ROURA IRON WORKS, INC.
3418 Woodland Ave., Detroit 11, Michigan

For more facts circle 653 on Reply Card

DATA FILE

(Begins on page 222)

pany's entire product line. A brief description of each product is provided. SKF Industries, Inc.
▲ For a copy, circle 380 on Post Card

Mounted Bearings—Comprehensive engineering data on pillow blocks, flange bearings, hanger bearings, bearing units and take-ups is presented in 82-pp Bulletin 10A. Includes dimensional data and diagrams, radial load rating tables, cutaway views showing component details of bearings. Dodge Mfg. Corp.
▲ For a copy, circle 381 on Post Card

Filled Teflon Bearings—Technical Bulletin CP-558 describes filled Teflon bearings designed for use as radial bearings on vertical pumps. Characteristics of filled Teflon bearing materials are discussed. Chemical & Power Products, Inc.
▲ For a copy, circle 382 on Post Card

Fluid Line Coupling—Catalog 100 contains data sheets describing company's line of quick-connective fluid-line couplings for pneumatic, hydraulic, oxygen, acetylene, steam, various gases and liquids service. Dimensions included. The Hansen Mfg. Co.
▲ For a copy, circle 383 on Post Card

Coupling Data—An integrated selection of product bulletins and data on couplings for a variety of industrial applications is presented in this handy ringbound note-book. The notebook contains sections on product literature, engineering data, instruction sheets, prices. Koppers Co., Inc.
▲ For a copy, circle 384 on Post Card

PACKINGS, SEALS

Compression Packings—Featured in this 22-pp catalog is a line of compression packings, including both sheet and rod seal types. Describes packing materials and includes sections on packings for various services. E. F. Houghton & Co.
▲ For a copy, circle 385 on Post Card

Piston Packing—Sixteen-pp Bulletin 5903 presents engineering data on Darcova Pumcups for packing pistons of air cylinders, hydraulic cylinders and reciprocating pumps. Included are operating diagrams and data, on Pumcup compositions. Darling Valve & Mfg. Co.
▲ For a copy, circle 386 on Post Card

Mechanical Seal—Performance and design features of Mechanipak PK mechanical seals for a variety of operating conditions are detailed in 8-pp Bulletin AD-150. Dimensional data included. Garlock, Inc.
▲ For a copy, circle 387 on Post Card

Mechanical Packings—Featured in 24-pp Catalog 60 are several recent packing developments including the multi-purpose Bel-Vee V-Ring packings, the long wearing crisscross braid packing series, twisted foil

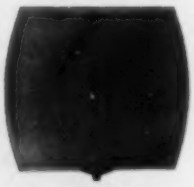
MULTI-METAL LEAVES
have the "GUTS" to make your filter work BETTER

by combining—

- Improved Chamber Design
- Correct Filter Media
- Stronger Leaf Assembly
- Adequate Outlet Fittings

These add up to greater filtering efficiency and service life. Bulletin 583—"Importance of Properly Designed Filter Leaves"—tells how Multi-Metal can help. Get a copy.

Multi-Metal all-plastic leaf, lightweight, strong, low cost.



Arc-side "RIM-LOK" leaf for horizontal tank, pressure filter.

"Multi-Leaf" covered with "Neva-Clog" for Sweetland filter.

Stainless steel bare leaf for rotary filter.

One of 8 leaf sectors of rotary vacuum filter.

Pressure filter leaf of bolted frame construction.

MULTI-METAL
WIRE CLOTH CO., INC.
1363 Garrison Ave., New York 59, N. Y.

For more facts circle 654 on Reply Card

packings for oil and distillate temperatures to 1000 F, and an Inconel-wire reinforced plastic packing. The Belmont Packing & Rubber Co.

▲ For a copy, circle 388 on Post Card

O-Ring Handbook—Catalog 5711 is a 24-pp design and data book on Viton O-rings. Contains test information on some 150 fluids and gases to which this synthetic elastomer is compatible; recommended design techniques; general information on three compounds and dimensions; and data on all standard sizes. Parker Seal Div., Parker-Hannifin Corp.

▲ For a copy, circle 389 on Post Card

ELECTRICAL

Shielded A-C Motors—Comprehensive 56-pp Catalog 200 includes complete dimensional, selection and application data on Multi-Shielded a-c motors. Includes information for various modifications. Sterling Electric Motors, Inc.

▲ For a copy, circle 390 on Post Card

Single-Phase Motors—Bulletin 470-B describes integral horsepower single-phase motors, ¾ to 20 hp, in open, protected, totally enclosed fan-cooled and explosion proof frames. Bulletin outlines company's "weatherizing" treatment which adapts motors for damp, dirty or corrosive atmospheres. Motor Div., Robbins & Myers, Inc.

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Motor Control—Commonly used motor control equipment is featured in this 42-pp product bulletin. Lists prices, dimensions and ratings for all types of switches, starters, relays, contactors, push button stations, pressure controls. Allen-Bradley Co.

▲ For a copy, circle 392 on Post Card

Distribution Transformers—Dry type distribution transformers, single and three phase, are featured in 16-pp Bulletin 5A2-BL01. Wiring diagrams provided. Acme Electric Corp.

▲ For a copy, circle 393 on Post Card

Enclosed Switches—Catalog 83, 22-pp. Catalog 84, 16-pp, and Catalog 101, 24-pp. describe enclosed switches for industrial uses. Included are general switches for use on a-c or d-c applications, sealed switches, heavy-duty limit switches, hand operated switches, others. Micro Switch Div., Minneapolis-Honeywell Regulator Co.

▲ For a copy, circle 394 on Post Card

Individually Enclosed Breakers—Featured in 8-pp Bulletin 4261-2B are individually enclosed low-voltage power circuit breakers featuring visible break disconnect contacts. Selection chart, application data given. I-T-E Circuit Breaker Co.

▲ For a copy, circle 395 on Post Card

Capacitor Guide—Featured in 26-pp Catalog C-913 are electrolytic capacitors for capacitor-start motors as well as capacitors for permanent split-phase capacitor motors, and capacitor-start, capacitor-run units for use in air conditioning. Selection tables and interchangeability guide included. Sprague Electric Co.

▲ For a copy, circle 396 on Post Card

Safety Switches—Bulletin 502, 10-pp, presents Shutlbrak front-operated, quick-make, quick-brake switches in heavy-duty and light-duty types. Provides ratings and discusses features contributing to safer operation, longer service, less maintenance. Frank Adam Electric Co.

▲ For a copy, circle 397 on Post Card

Dual-Element Fuses—Advantages offered by company's dual-element cartridge fuses are detailed in 12-pp Bulletin 1330. Describes knife-blade and ferrule types, and includes time current curves. Economy Fuse Div., Federal Pacific Electric Co.

▲ For a copy, circle 398 on Post Card

Magnetic Starters—Design features of a-c magnetic starters are detailed in 8-pp Bulletin PL 12-8-160. Describes arc quenching principle greater contact life under heavy current loads severe arcing conditions. The Clark Controller Co.

▲ For a copy, circle 399 on Post Card

Insulated Leads—Described in 8-pp Bulletin RCT 320 are PVC insulated leads for oil-filled transformers. Discusses particular insulation properties required for oil-immersed transformer leads (flexibility, oil resistance, heat stability) and compares these with properties of Synthinol 901. Rome Cable Div.

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Tougher... Lighter... Smaller
handles more air with minimum pressure drop
HANSEN
SERIES RL
QUICK-CONNECTIVE
RING LOCK
COUPLING
Handles any job in your shop using 3/4" to 1/8" connections – from the air line to the air tool – eliminates any need for various size couplings in hook-up – makes it easy to keep stock of parts in balance – holds inventories to a minimum.
All Series 2-RL Sockets and Plugs are completely interchangeable – likewise all larger Series 3-RL Sockets and Plugs.
Has fewer parts. Locking ring provides positive lock...tight fit...minimum wear. Equipped with automatic sleeve lock.
REPRESENTATIVES IN PRINCIPAL CITIES ... SEE YELLOW PAGES
Instant Automatic Flow or Shut-Off
Quick-Connective Fluid Line Couplings for... COMPRESSED AIR HYDRAULIC FLUIDS • OIL • GREASE • WATER VACUUM • STEAM • OXYGEN • ACETYLENE REFRIGERANTS • GASOLINE • COOLANTS • LP-GAS
Write for the Hansen Catalog
Here is an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes and types of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings.
SINCE 1915
QUICK-CONNECTIVE FLUID LINE COUPLINGS
THE HANSEN MANUFACTURING COMPANY
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Micromat®
AIR FILTER MEDIA
is the low-cost answer!

Dirt smudges around air diffusers . . . dirty walls, floors, machinery . . . dirt means high maintenance costs! You can reduce dirt problems — and expensive maintenance through *better air filtration* by low-cost MICROMAT Air Filter Media!

Developed by Microtron Corp., leader in synthetic fiber air filtration, economical MICROMAT media combine high dirt-catching efficiency with minimum air flow resistance. Soft, resilient, easier to handle and change, can be stored indefinitely. Use MICROMAT in frame, blanket, or roll machine installations — *outperforms conventional filters at any given air velocity.*

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For complete information on MICROMAT System of Air Filtration, write

Microtron CORPORATION
P. O. Box 2092 • Charlotte, N. C.

"Pioneers in better air filtration through synthetic fibers." 8515

For more facts circle 656 on Reply Card

DATA FILE

(Begins on page 222)

Flexible Electric Conduit—Performance and application data on company's line of flexible plastic covered electrical conduit, Liquatite, are featured in brochure. Electri-Flex Co.
▲ For a copy, circle 401 on Post Card

Flexible and Portable Cords—Featured in 40-pp Catalog 5-54 are flexible and portable cords, including lamp cords, heater cords, rubber jacket portable cords, Neoprene jacket cords, power cables, fixture wires, thermostat cables and bell wire. Royal Electric Corp.
▲ For a copy, circle 402 on Post Card

Sheathed Cable—Construction details and performance data on company's sheathed cable, available in steel, copper, aluminum and bronze, are presented in 16-pp bulletin 1031. Complete engineering data included. Simplex Wire and Cable Co.
▲ For a copy, circle 403 on Post Card

Safety Mineral Insulated Cable—Bulletin S-2-60, 20-pp, describes cable properties, applications, installation, construction and performance characteristics, electrical and mechanical properties and wiring specifications of mineral insulated cable for hazardous locations. Mineral Insulated Wire Div., General Cable Corp.
▲ For a copy, circle 404 on Post Card

Rubber Power Cable—This 32-pp catalog contains detailed information on design features, insulations, and performance highlights of butyl rubber power cable. Includes data on available constructions, ampacity, etc. Anaconda Wire & Cable Co.
▲ For a copy, circle 405 on Post Card

Basic Electrical Protection—Ten-pp Form BPB explains interrupting capacity, speed of response and current limitation. It contains detailed information on motor protection, system selectivity to faults, fuse applications and selection. Tells how to coordinate opening time of protective device so that fault current will be isolated. Bussmann Mfg. Co.
▲ For a copy, circle 406 on Post Card

Electrical Equipment—Collected in this bound catalog is a series of bulletins on electrical equipment including electric motors (250 hp. and larger) generators, motor-generator sets, switchboards and controls. Cutaway views showing design details included. The Ideal Electric & Mfg. Co.
▲ For a copy, circle 407 on Post Card

Electrical Equipment Digest—Electrical equipment illustrated and described in 168-pp Catalog Digest No. 143, includes load centers, circuit breakers, low voltage control, fusible service equipment and accessories, meter sockets and troughs, safety switches, panelboards, duct and fittings, starters. Square D Co.
▲ For a copy, circle 408 on Post Card

Electrical Products—Condensed Catalog No. 9 contains 48-pp of descrip-

LIGHT WEIGHT

REYNOLDS ALUMINUM RIGID CONDUIT

★ Easy to Cut
★ Easy to Thread
★ Easy to Handle
★ Easy to Bend
★ Less Voltage Drop
★ Locally Stocked

For complete information and names of Reynolds Aluminum Rigid Conduit Distributors, call your Reynolds Sales Office, or write: *Reynolds Metals Company, Box 2346-EQ, Richmond 18, Virginia.*

For more facts circle 657 on Reply Card

tive data on electrical products, including conduit bodies, conduit fittings, connectors, ground fittings and EMT fittings. Dimensional data provided. Gedney Electric Co.
For a copy, circle 409 on Post Card

Product Guide—This catalog is divided into sections covering company's product line, including wire connectors, electricians tools, electrical specialties, motor maintenance supplies, blowers and cleaners, production wire strippers, soldering equipment. Well illustrated with photos and diagrams, catalog contains complete dimensional data and specifications. Ideal Industries, Inc.
For a copy, circle 410 on Post Card

Control Batteries—Bulletin CP-540 describes features and advantages of batteries for control, switch-gear and auxiliary power. Engineering details and specifications are tabulated. C & D Batteries, Inc.
For a copy, circle 411 on Post Card

Silicon Chargers—A chart for determining proper silicon-rectifier charger to be used with stand-by batteries is incorporated in Bulletin 6258. Tabulating information on basic rectifier models, the chart lets you select chargers according to number of cells to be charged, output amperage, input voltage. Exide Industrial Div., The Electric Storage Battery Co.
For a copy, circle 412 on Post Card

Industrial Truck Batteries—Construction features and advantages of industrial truck batteries with silconic plate for longer battery life are detailed in 24-pp Bulletin GB-1567D. Includes curves showing discharge characteristics of various battery types, as well as capacity tables, layout specifications. Gould-National Batteries, Inc.
For a copy, circle 413 on Post Card

Control Units—Featured in profusely-illustrated 28-pp Publication LO-104 are pushbuttons, indicating lights, and selector switches combining compactness of design with flexibility and durability. Detailed selection data, specifications, dimensional data and diagrams. Cutler-Hammer, Inc.
For a copy, circle 414 on Post Card

Grounding Device—Easily-identified device designated "for grounding purposes only" is featured in this product booklet. Various types of connectors, receptacles and caps are illustrated. Harvey Hubbell, Inc.
For a copy, circle 415 on Post Card

Portable Test Units—Features and advantages of portable test units for circuit breakers are detailed in 16-pp Bulletin SB-CB-1. Covers typical test procedures, general considerations for testing, selector chart of test unit models for various sizes of circuit breakers, Multi-Amp Electronic Corp.
For a copy, circle 416 on Post Card

Wiring Devices—Catalog 60, about 80-pp, presents ordering data on wiring devices including a wide range of switches, convenience outlets, lampholders, fluorescent devices, cord connectors, adapters, wall plates, acces-

We bet millions on our couplings

When you buy a Fast's coupling, you can bet your bottom dollar everything was built on the spot, not assembled piece by piece from other suppliers. Koppers multi-million dollar manufacturing facilities are the most modern in the industry . . . with advanced program machines, highly accurate gear shapers, a complete forge shop.

For example, all Fast's Couplings are jig-drilled and jig-reamed for greater interchangeability of parts. Result: you get high-quality, smooth-running, long-lived units that are the choice of more equipment manufacturers than any other gear-type coupling.
KOPPERS COMPANY, INC., 1005 Scott Street, Baltimore 3, Md.

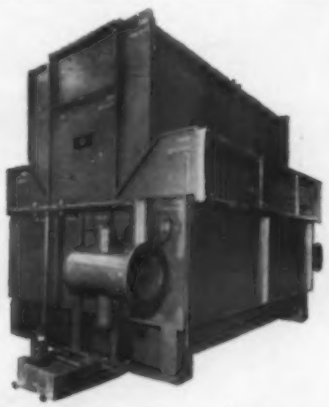
KOPPERS

FAST'S COUPLINGS

Engineered Products Sold with Service

For more facts circle 658 on Reply Card

You Get EXTRA SAVINGS From This Method of Compressed Air After Cooling



Cooling water savings and power savings quickly repay the cost of the Niagara Aero (air-cooled) After Cooler for compressed air or compressed gases. In addition its long life and the labor-saving simplicity of its maintenance give you an extra profit in comparison with water-cooled surface contact methods.

With the Niagara After Cooler the heat of compression is removed and dispersed into the atmosphere by the evaporation of a very small amount of water. The compressed air temperature is always brought below that of the atmosphere surrounding your air lines, so that no further condensation can take place.

Large users of compressed air for plant services or processes choose Niagara Aero After Coolers for their dependable durability. They have been making good records of service for over 25 years.

Write for Bulletin 130.

NIAGARA BLOWER COMPANY
Dept. PE-5, 405 Lexington Ave., New York 17, N. Y.
Niagara District Engineers in Principal Cities of U. S. and Canada

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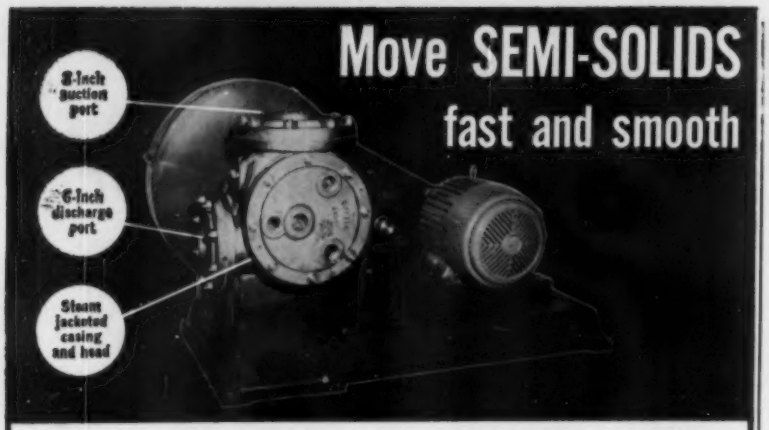

With VIKING ROTARY PUMPS

Moving thick, viscous materials is routine work for this Viking Pump because it's made to do that job. Vikings are built to cut costs and do jobs better. For example, like the unit shown above . . .

- The pump is all bronze.
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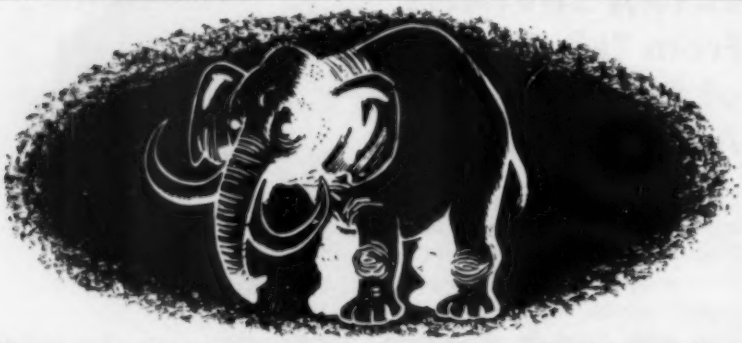

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Machinery Enclosures (shake table operations)

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(Begins on page 222)

sories, etc. Fully illustrated, provides condensed information on features, applications. Pass & Seymour, Inc.
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Electrical Connectors—Featured in 48 pp Bulletin 2711 is a line of electrical connectors, including plugs and receptacles in environment-resistant construction. Design and construction features are detailed and cutaway views included. Crouse-Hinds Co.
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LIGHTING

Modern Lighting Needs—"Footcandles in Modern Lighting," is a 20-pp revised booklet giving lighting level recommendations for seeing tasks involved in hundreds of activities. Figures are based on the findings of Illuminating Engineering Research Institute and Illuminating Engineering Society. General Electric Co.
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Lighting Selector—A simplified lamp and lighting guide for plant and office lighting, this 24-pp bulletin tabulates recommended illumination levels, and information on how to obtain them with fluorescent, mercury or filament lamps. Illustrated with products of ten manufacturers showing equipment recommended. Graybar Electric Co., Inc.
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Group Relamping Plan—Eight-pp Booklet A-6832 describes a group relamping plan designed to reduce costs, improve lighting, and cause fewer work interruptions. Sample calculations provide data for setting up schedule. Westinghouse Electric Corp.
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Lighting Fixtures—Illustrated and described in 24-pp 1961 Catalog are lighting fixtures for commercial and industrial applications. Includes selection tables for surface mounted, suspended mounted, special purpose, recessed, and industrial hangers and accessories. Day-Brite Lighting, Inc.
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Emergency Lighting—Twenty-pp Publication 243A features emergency lighting systems for commercial, industrial and other buildings. In addition to describing the systems, catalog contains information on components. The Standard Electric Time Co.
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Emergency Lighting—This 8-pp catalog provides operating data and prices on Light Warden automatic, battery-operated emergency lighting fixtures designed to operate instantly in event of power failure. Also details layout and installation information. Electric Cord Co.
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Lighting Maintenance Tips—Principles and advantages of good lighting

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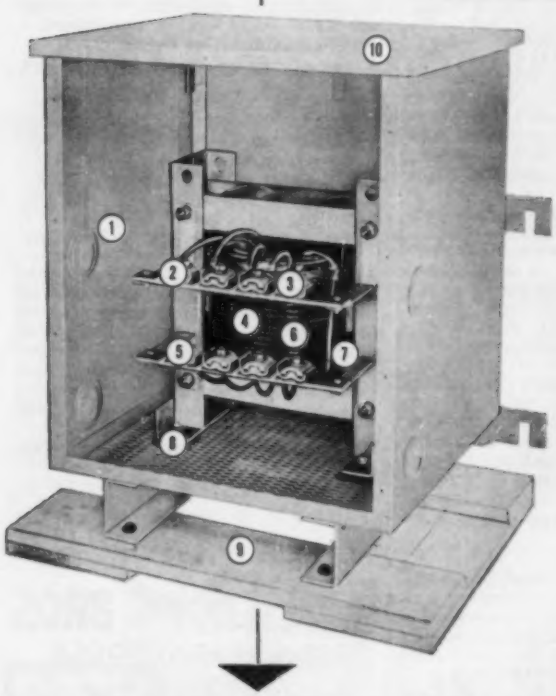

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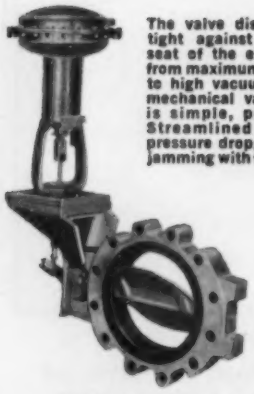
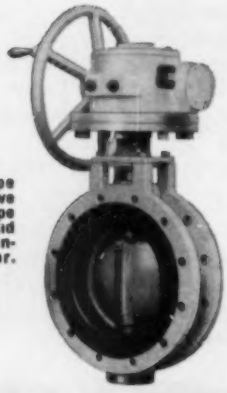


The valve disc seats drop-tight against the resilient seat of the elastomer liner from maximum line pressure to high vacuum. Manual or mechanical valve operation is simple, positive, fast. Streamlined design; low pressure drop; no fouling or jamming with foreign matter.

Wafer type butterfly valve with spool type rubber liner, available in "Keelok" snap-in, easily replaceable type or vulcanized to body. Shown with pneumatic operator. Bulletin 583.



Flanged type butterfly valve with spool type rubber liner and worm gear manual operator. Bulletin 582.

W. S. ROCKWELL CO.

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DATA FILE

(Begins on page 222)

practice are presented in this 48-pp revised lighting maintenance manual. Provides a guide to trouble shooting fluorescent installations, a section on planning group replacement of lamps, cleaning. Champion Lamp Works.
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LUBRICATION

Lubricant Data—Characteristics, advantages of specialized fluid and grease type lubricants are described in 32-pp Data Book 59-2. Covers control of friction, use of grease type lubricants, proper applications, and recommendations for various operating conditions. Lubri-plate Div., Fiske Brothers Refining Co.
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Extreme-Pressure Lubricant—Properties and applications of a semifluid extreme-pressure lubricant are detailed in Technical Bulletin 64. Specification data included. Sun Oil Co.
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Organized Lubrication—Benefits of organized lubrication—major cost control factors are extolled in this 24-pp bulletin. Cost control opportunities are detailed and the task of assigning responsibilities is covered as well. Texaco, Inc.
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Grease Cartridge—A simplified method of lubricating both stationary and rolling equipment with a grease-cartridge is described in Pamphlet SP-9672. Advantages of the multi-purpose grease cited. Gulf Oil Corp.
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Lever Guns—Bulletin 732 describes lever guns designed to handle lube cartridges and to dispense bulk grease. Describes convenient three-way reloading and other features. Lincoln Engineering Co.
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PUMPS, COMPRESSORS

Stainless Steel Pumps—Stainless steel as well as nickel, Monel, and other alloy pumps for handling corrosive liquids and those not permitting contamination are described in this 8-pp bulletin. Selection data given. Viking Pump Co.
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Rotary Gear Pumps—Features and advantages of the Gearex Pump which employs the basic rotary gear principle to move liquid are detailed in 6-pp Bulletin G-3. Cutaway view illustrates construction details. Sier-Bath Gear and Pump Co., Inc.
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Continuous Flow Pump—Bulletin 30-C, 8-pp, outlines advantages of company's Moyno pumps which handle a variety of materials—from free-flowing liquids to nonpourable pastes, abrasive solids. Describes principle of operation. Robbins & Myers, Inc.
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End Suction Pumps—Described in Bulletin 158 are horizontal shaft, single stage, and suction pumps designed for handling abrasive mixtures and slurries, as well as corrosive and hot liquid. Various models are described. Nagle Pumps, Inc.
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Simplified Pump Selection—Technical data is simplified in this company's rotary pump selection manual. Groups liquids according to viscosity and each classification has its own selection table. The Deming Co.
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Two-Stage Hydraulic Pump—Features of two-stage hydraulic pump, consisting of a gear pump for low pressure stage and five-cylinder, axial-piston pump for high pressure stage, are detailed in Bulletin V-1. Applications listed. Owatonna Tool Co.
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Air Compressors—Design and construction details on company's semi-radial air compressors are presented in 24-pp Bulletin A-72. Illustrates semi-radial construction which results in better balance, less weight, and quick installation. Joy Mfg. Co.
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Packaged Air Compressors—Illustrated and described in 6-pp Bulletin 203 are air cooled packaged air com-

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pressors for industrial applications. Longitudinal and transverse cross sections are included. Clark Bros. Co., Div., Dresser Industries, Inc.
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Jet Compressors—Bulletin 4F contains 16 pp of detailed information on jet compressors, including fixed-nozzle, manually controlled spindle, and automatically controlled spindle types. Covers construction, operation and application and includes nomograph to determine possible weight ratio of secondary gas to primary gas. Schutte and Koerting Co.
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Rotary Compressors—Described in 18-pp Bulletin C-5A are rotary compressors designed to operate at common electric motor and internal combustion engine speeds. Contains detailed specifications on compressors, rotary vacuum pumps. Fuller Co.
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Compressor Data—Feather valve compressors from 75 to 350 hp are described in 32-pp Bulletin 3620-B1. Advantages on installation, operation and maintenance costs are outlined for types YC and DYC compressors. Worthington Corp.
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HEATING, COOLING—

Hot Water System—How to provide hot water for the variety of requirements of an industrial plant without stretching the hot water system too far is the problem covered in this series of ring-bound bulletin. (Catalog 110) Various types of water heaters are illustrated. A. O. Smith Corp.
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Industrial Heating—Specifications and product illustrations of Chromalox electric heater bands, air heating elements, blower-type heaters, immersion units, mineral insulated heating cable, radiant heaters for process and comfort heating, controls and other equipment are contained in Catalog Supplement CS-600, 24 pp. Edwin L. Wiegand Co.
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Industrial Heaters—Detailed information on electric heaters for industrial applications is presented in 20-pp Bulletin EC-261-R. Illustrates suspension or portable heaters, duct heaters, natural convection and radiant convection heaters, infra-red heaters. Electromode Div., Commercial Control Corp.
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Infra-Red for High Bays—Design data, control arrangements and economic advantages of heating high bay buildings with gas fired infra-red heaters are explained in this bulletin. Mounting heights for different models and recommended minimum clearances from combustibles are tabulated. Perfection Div., Hupp Corp.
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Heating and Cooling—Products for heating and cooling with water, including booster pumps, relief and reducing valves, compression tanks, air vents and air chargers, indirect and tankless water heaters, tanks and heaters, heat exchangers are illustrated in 26-pp Bulletin GC-1259A. Selection data, diagrams of installations included. Bell & Gossett Co.
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Water Coolers—Selection and specification tables on water coolers, drinking fountains and filter purifiers are presented in this file folder of product literature. Dimensional data and diagrams, capacity tables and roughing-in details. Sunroc Corp.
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INSTRUMENTS, CONTROLS—

Analog Computer Control—Details on solid state analog computer control systems are presented in 6-pp Bulletin MSP-163. Describes solid state controllers with operational magnetic amplifiers, interchangeable components. Hagan Chemicals & Controls, Inc.
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Automatic Controls—Information on automatic controls for steam and water service is presented in this 46-pp engineer's manual. Covers controls for fuel oil heaters, heat exchangers for cooling, instantaneous heat exchangers, jacket water cool-

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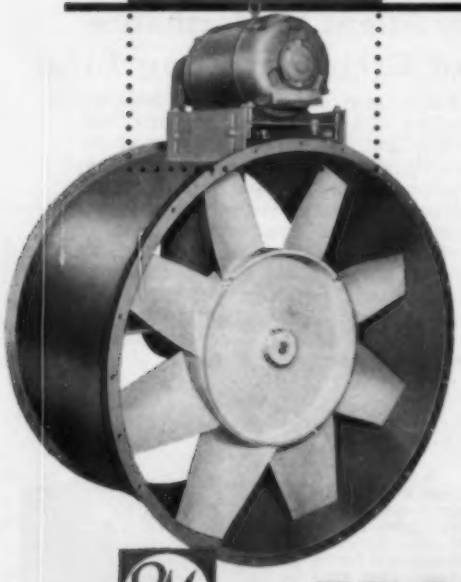

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(Begins on page 222)

ing, process hot water, pressure reducing. The Powers Regulator Co.
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Meters, Regulators, and Valves—Bulletin C-5000, 28-pp, describes meters, regulators and valves for a wide range of services. They include gas meters, gas pressure regulators, industrial meters, water meters. Information includes application suggestions. Rockwell Mfg. Co.
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For Pressure Measurement—Featured in 24-pp Catalog 2008 are U-type, well type and inclined tube manometers for measuring pressure of liquids and gases. Operating principles and points to consider in selecting a manometer are detailed. King Engineering Corp.
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Pneumatic Control—Design features and advantages of pneumatic control for air conditioning equipment are detailed in this 8-pp bulletin. Describes basic components of the pneumatic system. Johnson Service Co.
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Valve Operator—Applications and features of the Converto-Gear operator designed to fit wide variety of company's iron and steel gate valves, 2½ in. or smaller, are detailed in Form AD-2441. Crane Co.
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INSULATION

Calcium Silicate Insulation—Pipe and block insulation of calcium silicate for use in power, chemical, petroleum, petrochemical and manufacturing industries is featured in Form 6472. Lists heat transmission data, physical and thermal characteristics. Philip Carey Mfg. Co.
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Pipe Insulation—Properties and advantages of fiber glass pipe insulation are detailed in Bulletin F-110. Tables list dimensional and packing data. Pittsburgh Plate Glass Co.
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Piping Insulation—Seven-pp Bulletin SO 1054 features a snap-on, one-piece molded pipe insulation of fine-glass fibers for hot or cold piping. Gustin-Bacon Mfg. Co.
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For Insulation Protection—Comprehensive data on mastics, coatings, adhesives, and flashing compounds for thermal insulation has been classified as to industry usage—power, process, cold storage, marine and commercial—in this ready-reference loose-leaf manual, about 208-pp. Detailed application information and product data is included. Benjamin Foster Co.
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DUST, FUME CONTROL

Dust Collectors—Self-contained cabinet cloth-filter type dust collectors are illustrated and described in this 6-pp Bulletin 359. Torit Mfg. Co.
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Dust Control Systems—Bulletin 104, 36-pp, on company's dust filters, gives detailed information about dust control systems and how to engineer them. Includes description of the Roll-Clean Dynaclone dust filter. The W. W. Sly Mfg. Co.
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Dust and Fume Control — Applications of company's dust and fume control systems in ceramic, foundry, grain, metal, steel and wood industries are illustrated and described in 50-pp. Bulletin PE1-2. Design and specification data on centrifugal collectors. The Kirk & Blum Mfg. Co.
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Dust Collection, Recovery—Product bulletins on dust collection, precipitation and gas scrubbing equipment is provided in this literature folder. Equipment described includes electrical precipitators, mechanical dust collectors, gas scrubbers, others. Western Precipitation Corp.
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FANS, BLOWERS

Industrial Fans—Bulletin 690-A, 12-pp, contains dimensions and application and performance data on direct

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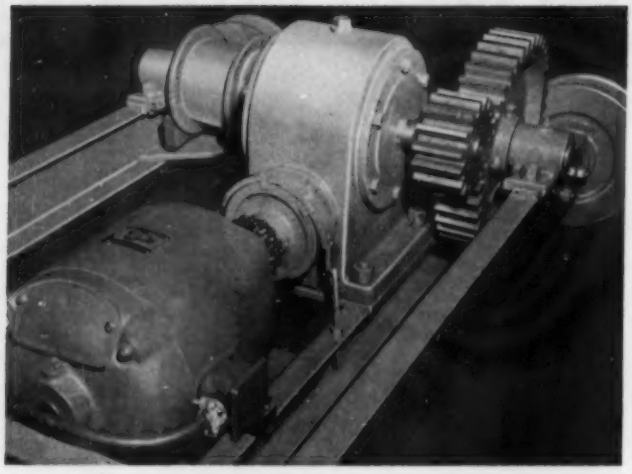

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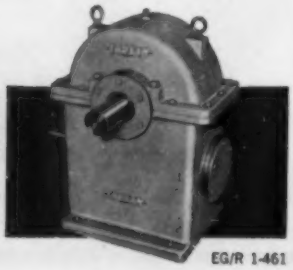

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DATA FILE

(Begins on page 222)

connected fans for general and system ventilation and power roof ventilators. Propellair Div., Robbins & Myers, Inc.
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Make-up Air Solutions—Bulletin EN-5911 explains how make-up air properly introduced and tempered overcomes negative air pressure and eliminates problems arising when fans draw fumes, smoke or odors. Outlines design of a make-up air system and tells how to select correct equipment. Reznor Mfg. Co.
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Air Moving Equipment—Bulletin DB-45, 20 pp, contains detailed information on roof ventilators, bifurcators, axial flow vent sets, and air jets. Bonded performance ratings are listed. DeBothezat Fans Div., American Machine and Metals, Inc.
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Air Engineering—Bulletin E-57 is a 24-pp air engineering data file covering engineering and test facilities for propeller fans, specifications, construction, maintenance, and installation. Tables for estimating air-handling requirements provided. Aerovent Fan Co., Inc.
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TOOLS, WELDING AND MACHINE SHOP

Pipe Tools—Ordering and application information on Rigid pipe tools is provided in 16-pp illustrated Catalog 7596R-6. Wrenches, cutters, threaders, reamers, vises, and others are pictured. The Ridge Tool Co.
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Electric Tools—Listed in this 12-pp Form 60 electric tools, attachments and accessories, including saws, drills, grinders, screw drivers, hammers, cutters, bits, polishers and others. Also covers portable, circular saws, vacuum cleaners. The Black & Decker Mfg. Co.
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Power Tools—Presented in this 68-pp 1961 catalog are electric and pneumatic power tools for production, maintenance, construction, wood and metalworking. Featured are worm drive and high speed saws; reciprocating saws; jig saws; hammers; planes; routers; orbital, sanders; drills; adjustable, positive and antiratcheting clutch drivers; wrenches; shears. Skil Corp.
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Brushing Tools—Illustrated and described in this 16-pp bulletin are brushing tools engineered for industry. Covers all types of brushes used in such applications as automatic deburring, manual deburring, off hand deburring, can cleaning and drying, fruit and vegetable cleaning, weld spatter removal, metal cleaning, metal processing. Newark Brush Co.
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Power Tool Guide—Portable electric tools and kits, including electric saws, sanders, drills, planes, routers, shapers, electric hammers, grinders, and combination tools are illustrated in 30-pp Catalog 108. Prices included. Porter-Cable Machine Co.
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Any of these bulletins, catalogs and technical booklets can be yours without cost or obligation. Use the Reader Service Cards on page 218.

Masonry Bits—Catalog M B C-56 describes carbide-tipped masonry bits for drilling holes in tile, brick, concrete, granite or other masonry. Specifications are included as well as chuck and shank requirements to adapt to different hammers. New England Carbide Tool Co., Inc.
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Fastening Tool—Illustrated and described in Catalog Form B-141 is the Duo-Jobmaster—designed to handle the tough fastening jobs into steel or concrete. Features and advantages detailed. Ramset Div., Olin Mathieson Chemical Corp.
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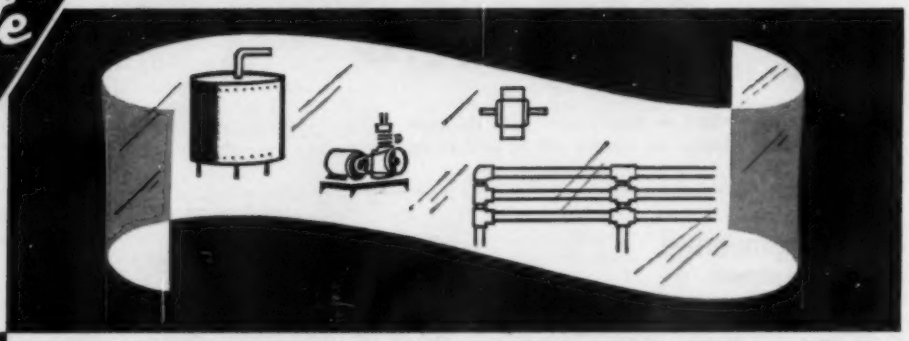

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(Begins on page 222)

Industrial Wrenches, Hand Tools—Tools for production lines, maintenance work and product servicing are presented in 156-pp Industrial Catalog 58-I. Loaded with pictures and tool facts, book describes in detail the complete line of over 4,000 tools—including chests and roll-cabs, wrenches and sockets of all types. Snap-on Tools Corp.
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FILTERING

Improved Filters—Bulletin GEO-507 describes Fulflo filters for compressed air and other gases, covering single tube models for operating pressures from below 125 psi to 4000 psi, and flow rates to 800 scfm, also multi-tube models for high flow rates. Commercial Filters Corp.
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Glass-Bag Filters—Features and advantages of glass-bag filters for cleaning hot, corrosive gases are described in 12-pp Bulletin 806. Typical installations are illustrated and methods of cleaning bags covered. Dracco Div., Fuller Co.
▲ For a copy, circle 475 on Post Card

Fabric Filter—Engineering and design features of fabric filters for industrial dust collection are detailed in Bulletin 150. John Wood Co.
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Filters for Industry—Illustrated and described in this product bulletin are filters for a variety of applications in industry. Among those covered are liquid filters, intake filters, pipe line filters, dry and viscous panel filters, precipitators, Electro-Staynew mist collector. The Dollinger Corp.
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SAFETY, FIRE PROTECTION—

Fire-Resistant Fluids—This series of specification sheets describes company's line of fire-resistant fluids including synthetic, oil-in-water and water-in-oil emulsion and glycol types. Mobil Oil Co., Inc.
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Handling Flammable Liquids—Problems involved in the use of flammables in individual processes, and methods and equipment required for safe control are described in this 76-pp safety handbook. Physical properties and characteristics of most commonly used flammables are detailed. The Protectoseal Co.
▲ For a copy, circle 479 on Post Card

Industrial Accident Prevention—Illustrated and described in 66-pp Catalog 11 is a wide variety of signs for industrial accident prevention, including danger signs, caution signs, directional signs, information signs and safety signs. Stonehouse Signs Inc.
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Fire-Resistant Resin—Structural panels, skylight louvers, chemical duct-work and other products made of Hetron, permanently flame-resistant polyester resin are covered in illustrated Bulletin D-6. Table lists characteristics. Durez Plastics Div., Hooker Chemical Corp.
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Signal Equipment—Tips on how to select suitable signals for any specific operations are offered in Bulletin 100. Describes horns, bells, warning lights, other signal equipment. Wiring diagrams, audibility rating charts. Federal Sign & Signal Corp.
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OTHER EQUIPMENT

Finishing Equipment—Contained in this file folder is a series of product bulletins on manual and automatic finishing equipment. Includes bulletins on spray guns and nozzles pumps, tanks, heaters, air compressors, regulators, hose. The De Vilbiss Co.
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Water Processing—Bulletin A-1, 8-pp, discusses and illustrates the chemistry of coagulation applied to effective treatment, practical approaches to problems, and solutions. Application of sodium aluminates; refined montmorillonites; cationic, anionic

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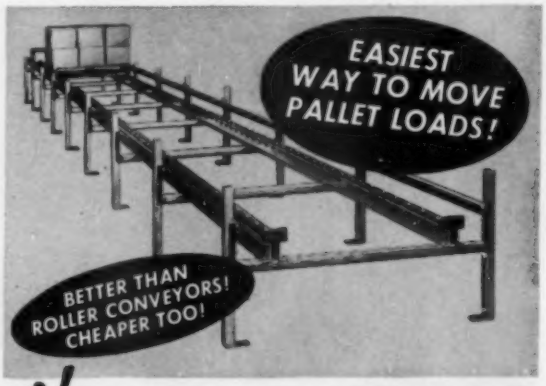

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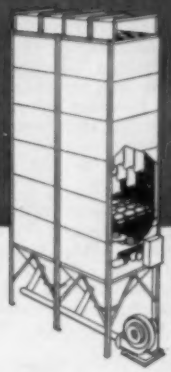

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DATA FILE

(Begins on page 222)

and non-ionic polymers; and "inline clarification," are described. Nalco Chemical Co.

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Liquid Absorbent Conditioner—Operation of company's air conditioner using a hygroscopic liquid absorbent is detailed in Bulletin 140. Diagram illustrates details of the conditioner and concentrator and graph shows water vapor equilibrium. Niagara Blower Co.

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Equipment Upkeep—"The ABC's on Maintenance of Air and Hydraulic Equipment," is a 24-pp cartoon-type booklet presenting the "rights" and "wrongs" in setting up and servicing air and hydraulic equipment. Major reasons for unsatisfactory performances and steps to prevent them outlined. Logansport Machine Co., Inc.

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Rectangular Collectors—Straightline sludge collectors are described in 28-pp Book 2746. Data provided enables selection of proper size tank for both Types H and L collectors. "Ten States Standards for Sewage Works," specifications for sedimentation tanks are reprinted. Also shows Uniflow and preaeration tanks. Link-Belt Co.

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Galvanized Steel Sheets—Characteristics and advantages of Ti-Co nonflaking galvanized steel sheets designed for use in all types of products where corrosion resistance is required are detailed in this 10-pp product bulletin. Typical applications in sheet metal work are illustrated. Inland Steel Co.

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Carbon Graphite Materials—Bulletin S-5425 is an 8-pp engineering guide on carbon-graphite materials for mechanical applications. Tabulates 18 grades of carbon, graphite and carbon-graphite for use in bearings, bushings and seals and lists properties for each grade. National Carbon Co., Div. of Union Carbide Corp.

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Plumbing Specialties—Illustrated and described in 12-pp Catalog O are concave cushions, flat bibb washers, screws, packings, repair kits, floats, tank bulbs, slip joint washers, hack saw blades, etc. Includes detailed selection information. Good Mfg. Co.

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Springs and Formed Wires—Catalog S-500 (and Supplement S-502) contains 28 pp of detailed information and technical data on helical springs (compression, extension, torsion), flat wire springs and formed wires. Includes charts, tables and formulae on physical properties and tensile strengths. The Colorado Fuel and Iron Corp.

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Air Handling Equipment—Illustrated and described in this product bulletin is a complete line of air handling, air cleaning, air conditioning and mechanical draft equipment. Covers heating and ventilating equipment, industrial processes and mechanical draft apparatus, cooling and dehumidifying, and electronic air cleaners. Westinghouse Electric Corp.

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Double-Flow Aquatower—Bulletin DFA15-60 describes double-flow Aquatower designed to bridge the gap between standard double-flow Aquatowers and unlimited capacity industrial cooling towers. Specifications and engineering data included. The Marley Co.

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On Blast Cleaning—Illustrated and described in 24-pp Bulletin 1230 are blast cleaning and finishing methods and equipment. Features blast cleaning barrels, tables, descaling machines, as well as dust control equipments, abrasives. Pangborn Corp.

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Flame Spraying Processes—Basic engineering and application data on flame-sprayed coatings of metals, ceramics, carbides and other high melting point materials is presented in 16-pp Bulletin 136B. In addition to covering basic engineering considerations for each process, it includes tables and charts on specific characteristics. Metco, Inc.

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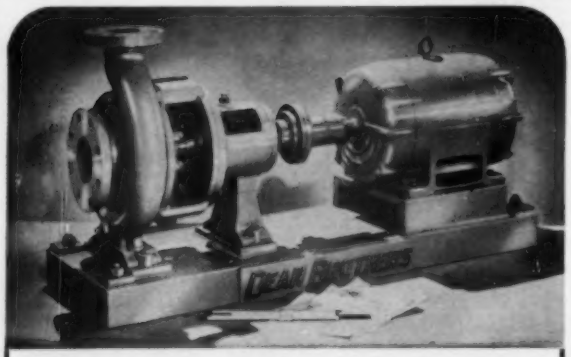

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The quality of leadership!

The leaders of hundreds of America's major industries have, for twenty years, matched beliefs with action by supporting the Payroll Savings Plan for U.S. Savings Bonds. On this, the 20th Anniversary of this great idea, we salute the quality of leadership which continues to use this plan to create reserve public buying power, improve employee morale and strengthen the economy of our country. To learn how your company can benefit from the Payroll Savings Plan, write: **U.S. SAVINGS BONDS DIVISION, TREASURY DEPARTMENT, Washington 25, D.C.**

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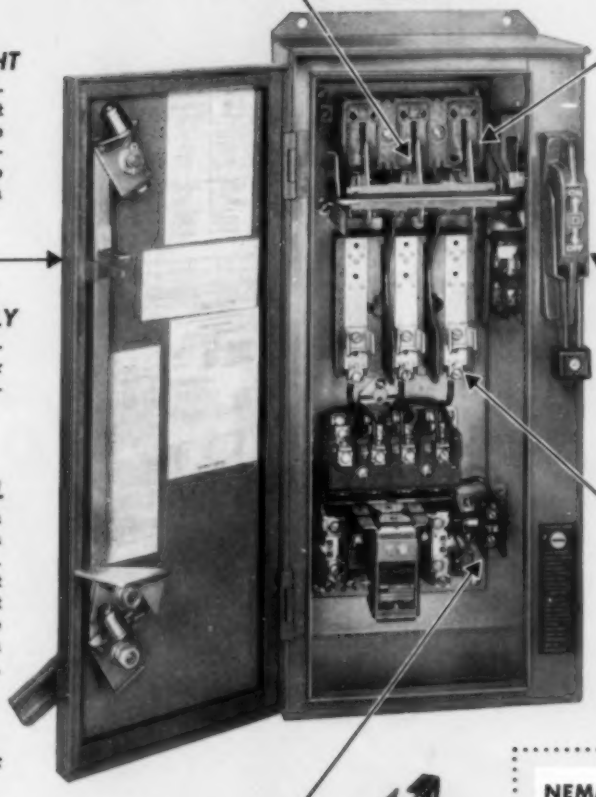
All these Square D features make this

THE SAFEST, MOST RELIABLE COMBINATION STARTER

VISIBLE BLADES You can see the switch is open and know you're safe!



REALLY DUST-TIGHT

NEMA 5-12 construction keeps out dust and coolant. Positive door-closing mechanism assures complete seal before switch can be operated.

DOOR CLOSES SIMPLY and EASILY

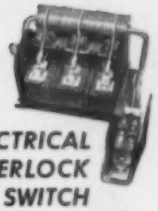
No cover bolts to secure—just push door shut and turn door handle to close and seal.

EASY TO INSTALL

Through wiring with no interference from disconnect switch. Line terminals are at top, load terminals at bottom. Starters can be ganged with less than ½ inch between them.

WIDE RANGE OF SIZES

New Square D combination starter now available in NEMA Sizes 0 through 4.



ELECTRICAL INTERLOCK ON SWITCH

Optional single or double-pole interlock available to disconnect separate control circuit power. Assures complete safety!

FOOL-PROOF OPERATING MECHANISM

Handle is permanently attached to switch to eliminate hazard of false handle indication. With door open, the switch can not be operated accidentally.

CONVERTIBLE FUSE CLIPS

If horsepower or voltage requirements change, modification kits provide easy change of fuse clip size and spacing.

3rd OVERLOAD RELAY

Space to add an additional overload relay when desired.

NEMA TYPE 1 ENCLOSURE ALSO AVAILABLE

NEMA Type 1 enclosures, offered in Sizes 0 through 4, can be modified by addition of a pushbutton, selector switch or other accessories. Easy-to-use kits simplify field installation.

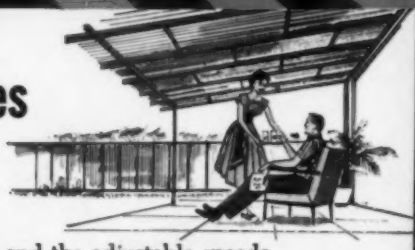
Write for Bulletin SM-292. Address Square D Company, Dept. SA, 4041 North Richards Street, Milwaukee 12, Wis.

SQUARE D COMPANY

wherever electricity is distributed and controlled

For more facts circle 686 on Reply Card

U.S. VARIDYNE system coordinates variable speed, multi-motor range drives



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Solution: U. S. VARIDYNE a/c Drive System on each of these long range drives has provided both the multi-motor coordination and the adjustable speeds required. Working with U. S. Motors field engineers, Filon's engineering staff determined that considerable savings in original installation costs as well as in operating and maintenance costs could be achieved with VARIDYNE, which varies motor speeds by varying the frequency of the current in the circuit. Motors are thus kept "in step" at all speeds. *Write today for* VARIDYNE *Brochure F-1963.*

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